TRMM

SOLAR ARRAY

FINAL REPORT

NASA CONTRACT NO. – NAS5-32464

TRW SALES NO. – 61058

TRMM SOLAR ARRAY

FINAL REPORT

FEB 2 4 1998

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TRMM SOLAR ARRAY REPORT

CONCLUSIONS/RECOMMENDATIONS:

- Basic requirement of 978.59 watts per Panel output @ 58.9 volts B.O.L. was met on an average basis per agreement with NASA. Lower grade Cells were used on the shadowed Panel (Boom shadow) to maximize available power to the Spacecraft. The average output @ 58.9 volts was 991 watts. The outputs of the four (4) Panels ranged from 960 to 1,022 watts. The Panels successfully passed environmental testing at TRW to the contract specification and subsequent testing at NASA which involved output measurements at elevated temperatures.

- As this type of Array had never previously been built by TRW (aluminum Substrate with 4 cm x 4.4 cm GaAs Cells), the TRMM Program was a development effort combined with a Qual and Flight production effort. The most significant technical problem was Cell cracking during Qual thermal cycling. The cracking problem was determined to be generic within our Solar Array factory in the application of GaAs Cells to our designs. As a result, a TRW funded manufacturing process verification panel (known as the Manufacturing Verification Panel) was built to demonstrate our ability to properly apply GaAs Cells. The original Qual Panel comprised three (3) design variations with respect to Coverglass-to-Cell and Cell-to-Substrate adhesives. The intent was to qualify multiple designs in case one or more failed. When two of the three combinations failed due to excessive Cell breakage during thermal cycling, NASA was reluctant to allow Flight production based on the one remaining good Qual Panel Quadrant. This issue was pivotal for continuing the contract. Facts and recommendations are as follows:

  - The cause of the excessive cracking was never determined.

  - The areas where the excessive cracking occurred utilized DC93-500 glassing adhesive which was NASA approved, and had been widely used by TRW on a multitude of projects.

CONCLUSIONS/RECOMMENDATIONS (Cont'd.):

- The Manufacturing Verification Panel was built utilizing the successful Qual Panel Quadrant design (CV4-2500 glassing adhesive and CV1-1142 Cell-to-Substrate adhesive). The Panel was constructed utilizing consistent manufacturing processes which were subject to a higher level of control than those used on the original Qual Panel. The processes utilized on the original Qual Panel varied for the same operations for schedule expediency and were not well controlled. The Manufacturing Verification Panel passed all requirements except for one cracked Cell. Key lessons learned from this experience are:

  - When multiple designs are to be qualified or "select-in-test" methodology utilized, the Customer and the Contractor must agree on a detail plan with specific pass-fail criteria. A more conservative approach would be to build and test Engineering Model Panels in advance of the Qual Panel or multiple Qual Panels.

  - As manufacturing process consistency was an issue with Qual Panel Cell breakage, much attention was levied at duplication of manufacturing processes on the Flight Panels. As "manual" soldering and glassing techniques are required to back-up the automated equipment processing, agreement on use of all processing procedures should be in place prior to Qual or Flight Panel fabrication.

CONCLUSIONS/RECOMMENDATIONS (Cont'd.):

- Reverse Bias Testing: In future contracts, reverse bias requirements should be more definitive.

  - Lack of clarity in the original TRMM specification caused a contract modification to re-screen existing Cells and screen future ASEC production to 1.1 times the short circuit current. As the modification was enacted during the Cell production at ASEC, a significantly higher price was paid to re-screen existing Cells than the cost for screening the Cells during the basic production run.

  - The above referenced modification required screening at ambient temperatures. A separate specification section (4.10.9) required a dedicated Reverse Bias Test Panel which was tested at –80°C and again at +85°C. The Cells passed the cold cycle but failed (greater than 3% degradation) the hot cycle. ASEC could not explain the failure mechanism. A waiver was submitted and approved by NASA. In the future, the reverse bias requirement for the basic Cells should encompass all other reverse bias considerations.

REQUEST FOR DEVIATION/WAIVER

(See MIL-STD-480 or 481 for instructions)

DATE (YYMMDD): 95/06/19

Form Approved OMB No. 0704-0188

PROCURING ACTIVITY NUMBER

1. ORIGINATOR NAME AND ADDRESS

TRW Space & Electronics Group

2. [ ] DEVIATION [X] WAIVER

3. [X] MINOR [ ] MAJOR [ ] CRITICAL

4. DESIGNATION FOR DEVIATION/WAIVER

a. MODEL TYPE	b. CAGE CODE	c. SYS. DESIG.	d. DEV/WAIVER NO.
	11982		W001

5. BASELINE AFFECTED [ ] FUNCTIONAL [ ] ALLOCATED [ ] PRODUCT

6. OTHER SYSTEM/CONFIGURATION ITEMS AFFECTED [ ] YES [X] NO

7. SPECIFICATIONS AFFECTED - TEST PLAN

8. DRAWINGS AFFECTED

	CAGE CODE	SPECIFICATION/DOCUMENT NO.	REV.	CAGE CODE	NUMBER	REV.
a. SYSTEM		TRMM-711-058				
b. ITEM		CCR 0B-0457				
c. TEST PLAN						

9. TITLE OF DEVIATION/WAIVER
Qual Panel Thermal Cycling

9.a. WEAPON SYSTEM CODE OR DESIGNATION
N/A

10. CONTRACT NO. AND LINE ITEM
NAS 5-32464

11. PROCURING CONTRACTING OFFICER
Joseph Kroener
CODE 284.4 TEL (301) 286-3294

12. CONFIGURATION ITEM NOMENCLATURE
Qualification Panel

13. CLASSIFICATION OR DEFECT

a. CD NO.	b. DEFECT NO.	c. DEFECT CLASSIFICATION
		[X] MINOR [ ] MAJOR [ ] CRITICAL

14. NAME OF LOWEST PART/ASSEMBLY AFFECTED
Qualification Panel

15. PART NO. OR TYPE DESIGNATION
D828370-1-900

16. LOT NO.
N/A

17. QTY
One

18. RECURRING DEVIATION/WAIVER [ ] YES [X] NO

19. EFFECT ON COST/PRICE
None

20. EFFECT ON DELIVERY SCHEDULE
None

21. EFFECT ON INTEGRATED LOGISTICS SUPPORT, INTERFACE OR SOFTWARE
None

22. DESCRIPTION OF DEVIATION/WAIVER
See attached.

23. NEED FOR DEVIATION/WAIVER
See attached.

24. SERIAL NUMBER(S) AFFECTED
N/A

25. SUBMITTING ACTIVITY AUTHORIZED SIGNATURE
Lee C. Pekarek Lee C. Pekarek 19 June 95

25. a. TITLE
Program Manager

26. APPROVAL/DISAPPROVAL a. RECOMMEND [ ] APPROVAL [ ] DISAPPROVAL

b. APPROVAL	c. GOVERNMENT ACTIVITY	SIGNATURE	DATE (YYMMDD)
[ ] APPROVED [ ] DISAPPROVED			

d. APPROVAL	e. GOVERNMENT ACTIVITY	SIGNATURE	DATE (YYMMDD)
[ ] APPROVED [ ] DISAPPROVED			

DD Form 1694, JUL 88

National Aeronautics and
Space Administration
Goddard Space Flight Center
Greenbelt, MD 20771

Reply to Attn of: 734.4

August 17, 1995

Mr. Lee Pekarek, Program Manager
TRMM Solar Array Contract NAS5-32464
TRW Space and Electronic Group
One Space Park
Redondo Beach, CA 90278

Dear Mr. Pekarek:

We have reviewed the letter "Solar Cell Glassing Adhesive Inhibition & Washout" and the Request for deviation / Waiver. GSFC approves the request with conditions.

Condition #1: All uncured adhesive shall be removed after the back side soldering and prior to panel assembly.

Condition #2: This relaxation of the coverglass void criteria shall not change the final power requirement as called for in the Specification.

for Vickie Moran
TRMM Power System Engineer

cc:
284.4/ Mr. S. Metcalf
303 / Mr. L. Moore
722.2/ Mr. J. Lawrence
734.4/ Mr. E. Gaddy
734.4/ Mr. R. Stegeman (J&T)

REQUEST FOR DEVIATION/WAIVER

(See MIL-STD-480 or 481 for instructions)

DATE (YYMMDD): 95/08/16

Form Approved
OMB No. 0704-0188

PROCURING ACTIVITY NUMBER:

1. ORIGINATOR NAME AND ADDRESS
TRW Space & Electronics Group

2. [X] DEVIATION [ ] WAIVER

3. [X] MINOR [ ] MAJOR [ ] CRITICAL

4. DESIGNATION FOR DEVIATION/WAIVER

a. MODEL TYPE	b. CAGE CODE	c. SYS. DESIG.	d. DEV/WAIVER NO.
	11982		W003

5. BASELINE AFFECTED
[ ] FUNCTIONAL [ ] ALLOCATED [X] PRODUCT

6. OTHER SYSTEM/ CONFIGURATION ITEMS AFFECTED
[ ] YES [X] NO

7. SPECIFICATIONS AFFECTED - TEST PLAN

	CAGE CODE	SPECIFICATION/DOCUMENT NO.	REV.
a. SYSTEM		TRMM-711-058	
b. ITEM			
c. TEST PLAN			

8. DRAWINGS AFFECTED 828373

CAGE CODE	NUMBER	REV.

9. TITLE OF DEVIATION/WAIVER
Glassing

9.a. WEAPON SYSTEM CODE OR DESIGNATION

10. CONTRACT NO. AND LINE ITEM
NAS 5-32464

11. PROCURING CONTRACTING OFFICER
Joseph Kroener
CODE 284.4 TEL (301) 286-3294

12. CONFIGURATION ITEM NOMENCLATURE
Flight Solar Cell Stacks

13. CLASSIFICATION OR DEFECT

a. CD NO.	b. DEFECT NO.	c. DEFECT CLASSIFICATION
		[X] MINOR [ ] MAJOR [ ] CRITICAL

14. NAME OF LOWEST PART/ASSEMBLY AFFECTED
Solar Cell Stacks

15. PART NO. OR TYPE DESIGNATION
828373

16. LOT NO.
N/A

17. QTY
9248

18. RECURRING DEVIATION/WAIVER
[ ] YES [X] NO

19. EFFECT ON COST/PRICE
N/A

20. EFFECT ON DELIVERY SCHEDULE
N/A

21. EFFECT ON INTEGRATED LOGISTICS SUPPORT, INTERFACE OR SOFTWARE
N/A

22. DESCRIPTION OF DEVIATION/WAIVER
See attached.

23. NEED FOR DEVIATION/WAIVER
Minor variances to glassing void specification discovered during cell stack inspection under magnification. Additionally a few instances (less than 4 units of 2700 inspected) show evidence of uncured adhesive around the cell edges. Deviation requested to minimize MRB activity, attendant handling, and significant schedule delays.

24. SERIAL NUMBER(S) AFFECTED
N/A

25. SUBMITTING ACTIVITY AUTHORIZED SIGNATURE
Lee Pekarek — Lee C. Pekarek 16 Aug 95

25. a. TITLE
Program Manager

26. APPROVAL/DISAPPROVAL a. RECOMMEND [ ] APPROVAL [ ] DISAPPROVAL

b. APPROVAL	c. GOVERNMENT ACTIVITY	SIGNATURE	DATE (YYMMDD)
[X] APPROVED * [ ] DISAPPROVED	21 Aug 95 Vickie Eaton Moran		

d. APPROVAL	e. GOVERNMENT ACTIVITY	SIGNATURE	DATE (YYMMDD)
[ ] APPROVED [ ] DISAPPROVED			

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* contingent upon the satisfaction of conditions #1 + #2 in letter dated Aug 17, 1995 regarding W003.

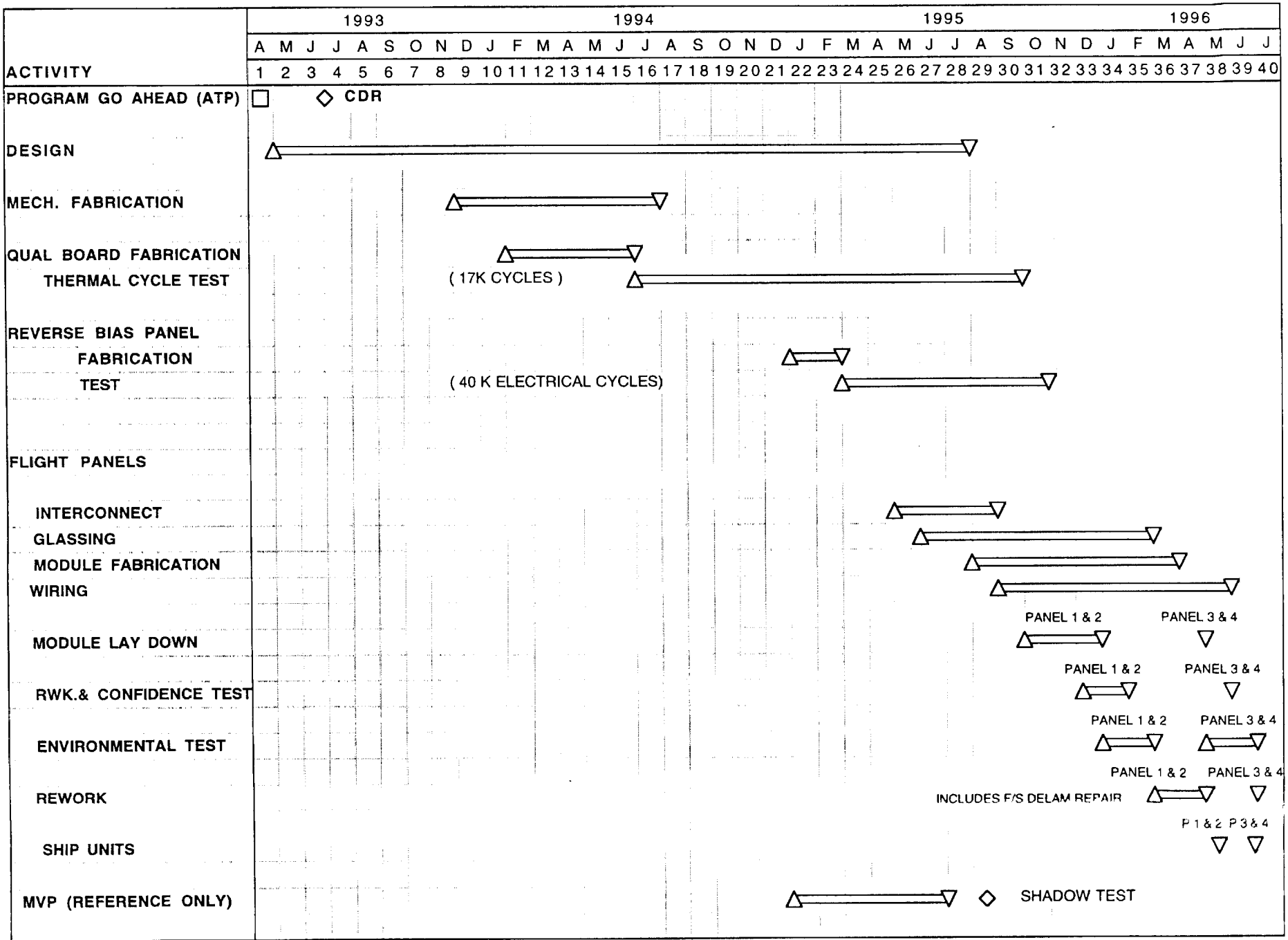
TRMM SOLAR ARRAY

FLIGHT HARDWARE DELIVERABLES:

	TRW Drawing No.	Qty.	Description
• Solar Panels	828340-1	1 Ea.	+Y Outboard
	828340-2	1 Ea.	–Y Outboard
	828350-1	1 Ea.	–Y Inboard
	828360-1	1 Ea.	+Y Inboard
• Inter-Panel Harnesses	828383-1	1 Ea.	Interconnect, –Y Power
	828383-2	1 Ea.	Interconnect, –Y Power
	828385-1	1 Ea.	Interconnect, –Y Signal
	828387-1	1 Ea.	Interconnect, +Y Power
	828387-2	1 Ea.	Interconnect, +Y Power
	828389-1	1 Ea.	Interconnect, +Y Signal

R. BRIG
EXT. 39708

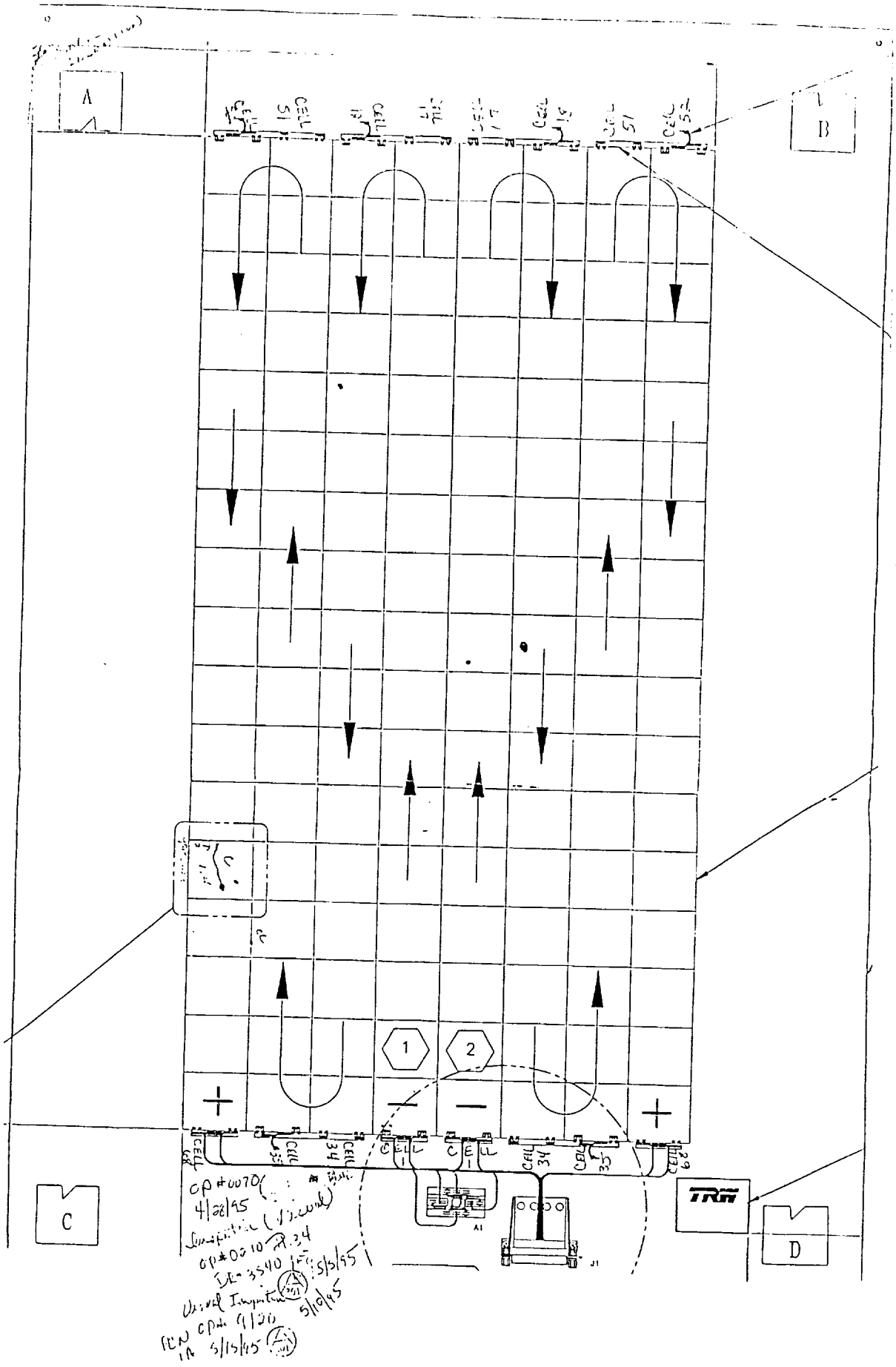
TRMM SCHEDULE ...STORY SUMMARY



Thursday, January 9, 1997

Section 3.0 Waivers and Deviations

- Note: All waivers and deviations were formally approved by NASA



MSO # PL BA SA 0014 D

op#0070 4/28/95
op#0010 P.34 DE-3540 5/5/95
5/10/95
5/15/95

oper. 9/95 Visual Prior to delivery No damage to test area found. oper. Accept. 5/17/95

op. 9210 Visual Insp (BA1A) No damage found Accept

REQUEST FOR DEVIATION/WAIVER (continued)

22. Description of Deviation/Waiver

- Reference current specification TRMM-711-058 CCR 0B-0457 Section 3.10.4.1.

- The qualification panel has satisfactorily completed all requirements of this section with the following exception

  1 crack on 1 cell appeared during the thermal cycle interval #21 through #1000. The crack does not adversely impact the panel electrical output as demonstrated by post #1000 cycle flash testing. For reference note that this crack was the only one resultant during all the environmental testing (acoustic and thermal cycling). A map of the cell crack is attached.

23. Need for Deviation/Waiver

NASA-GSFC concurrence to proceed with flight cell stack fabrication is required. TRW hereby requests the authorization to initiate the cell glassing process.

REQUEST FOR DEVIATION/WAIVER

(See MIL-STD-480 or 481 for instructions)

DATE (YYMMDD): 95/07/05

Form Approved OMB No. 0704-0188

PROCURING ACTIVITY NUMBER

1. ORIGINATOR NAME AND ADDRESS

TRW Space & Electronics Group

2. [ ] DEVIATION [X] WAIVER

3. [X] MINOR [ ] MAJOR [ ] CRITICAL

4. DESIGNATION FOR DEVIATION/WAIVER

a. MODEL TYPE	b. CAGE CODE	c. SYS. DESIG.	d. DEV/WAIVER NO.
	11982		W001 Rev. #1

5. BASELINE AFFECTED [ ] FUNCTIONAL [ ] ALLOCATED [ ] PRODUCT

6. OTHER SYSTEM/ CONFIGURATION ITEMS AFFECTED [ ] YES [X] NO

7. SPECIFICATIONS AFFECTED - TEST PLAN

	CAGE CODE	SPECIFICATION/DOCUMENT NO.	REV.
a. SYSTEM		TRMM-711-058	
b. ITEM		CCR 0B-0457	
c. TEST PLAN			

8. DRAWINGS AFFECTED

CAGE CODE	NUMBER	REV.

9. TITLE OF DEVIATION/WAIVER: Qual Panel Thermal Cycling

9.a. WEAPON SYSTEM CODE OR DESIGNATION: N/A

10. CONTRACT NO. AND LINE ITEM: NAS 5-32464

11. PROCURING CONTRACTING OFFICER: Joseph Kroener
CODE 284.4 TEL (301) 286-3294

12. CONFIGURATION ITEM NOMENCLATURE: Qualification Panel

13. CLASSIFICATION OR DEFECT

a. CD NO.	b. DEFECT NO.	c. DEFECT CLASSIFICATION
		[X] MINOR [ ] MAJOR [ ] CRITICAL

14. NAME OF LOWEST PART/ASSEMBLY AFFECTED: Qualification Panel

15. PART NO. OR TYPE DESIGNATION: D828370-1-900

16. LOT NO.: N/A

17. QTY: One

18. RECURRING DEVIATION/WAIVER [ ] YES [X] NO

19. EFFECT ON COST/PRICE: None

20. EFFECT ON DELIVERY SCHEDULE: None

21. EFFECT ON INTEGRATED LOGISTICS SUPPORT, INTERFACE OR SOFTWARE: None

22. DESCRIPTION OF DEVIATION/WAIVER: See attached.

23. NEED FOR DEVIATION/WAIVER: See attached.

24. SERIAL NUMBER(S) AFFECTED: N/A

25. SUBMITTING ACTIVITY AUTHORIZED SIGNATURE: Lee C. Pekarek 5 Jul 495

25.a. TITLE: Program Manager

26. APPROVAL/DISAPPROVAL a. RECOMMEND [ ] APPROVAL [ ] DISAPPROVAL

b. APPROVAL	c. GOVERNMENT ACTIVITY	SIGNATURE	DATE (YYMMDD)
[X] APPROVED [ ] DISAPPROVED	TRMM FAM	Thomas J. Lawler	10/16/95
d. APPROVAL	e. GOVERNMENT ACTIVITY	SIGNATURE	DATE (YYMMDD)
[X] APPROVED [ ] DISAPPROVED	TRMM COTR	Vickie E. Moran	10/16/95

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REQUEST FOR DEVIATION/WAIVER (continued)

22. Description of Deviation/Waiver

- Reference original Waiver No. W001, dated 95/06/19.

- This revision is being submitted due to finding an additional crack on the same cell referenced in the original waiver. This revision should be considered an addition to the original Waiver No. W001. The additional crack is documented on the attached road map. The additional crack was discovered during a review of the panel with NASA personnel on 6/28/95.

- Two possibilities exist regarding the occurrence of the additional crack.

  1. The additional crack could have existed at the time the original crack, documented in the original waiver, was found and was missed by the two inspectors who independently examined the panel. One of the technical functional managers remarked during the 6/28/95 review that he had seen the additional crack prior to 6/28/95, although he is uncertain as to the exact time frame. No TRMM personnel were aware of any crack other than the one documented in the 6/28/95 review.

  2. The additional crack could have occurred after the post-1000 thermal cycle inspection point due to residual stresses in the cell or poor handling. The following operations were performed after the inspection point during which the additional crack could have occurred:

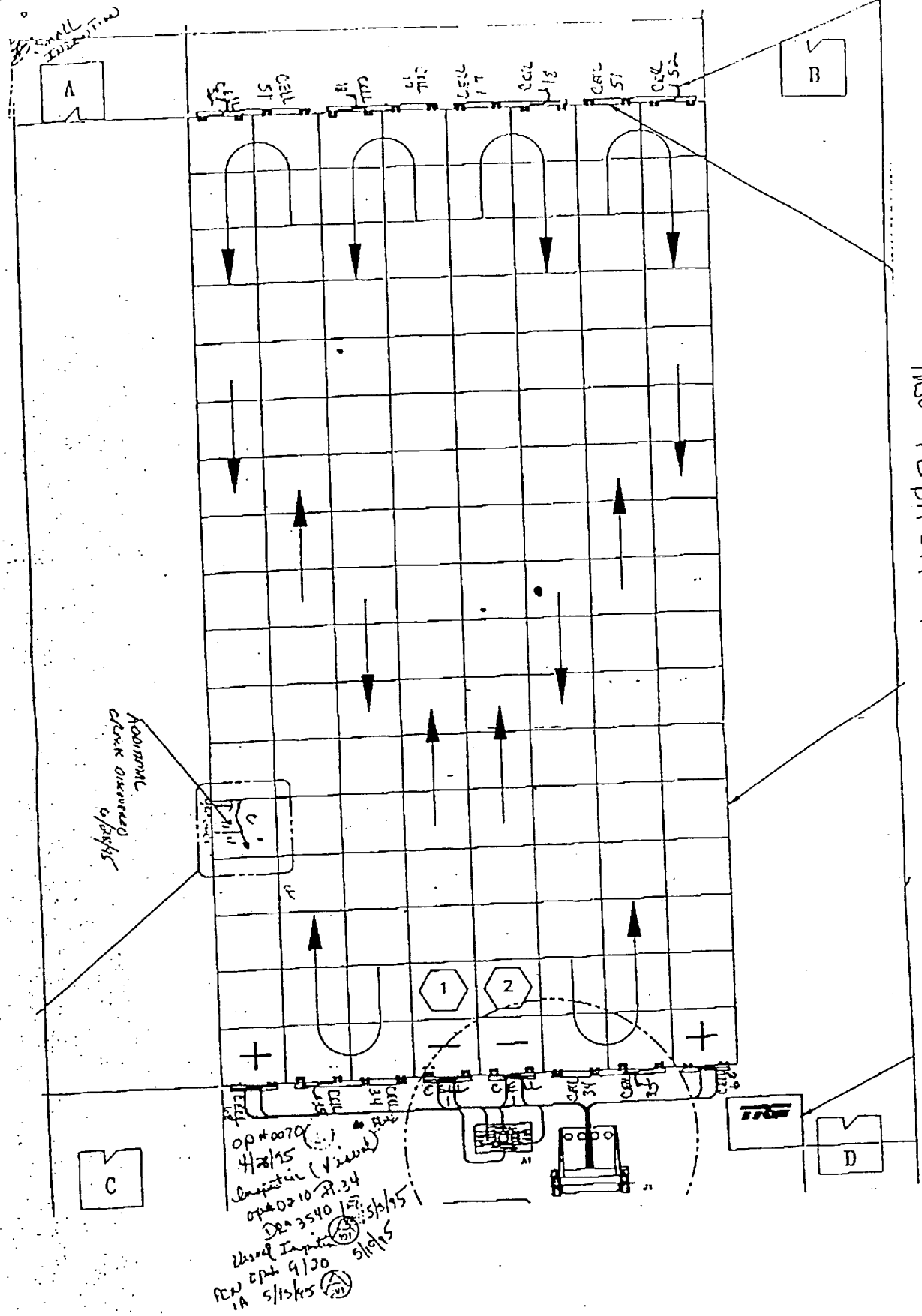
     Electrical Flash Test - Two separate sets of tests were performed, each requiring setup and handling.

     X-ray Inspection - The panel was transported to another building for this test.

     Transportation back to the solar manufacturing and subsequent handling for photography.

After reviewing the additional crack with the two inspectors who performed the post-1000 thermal cycle inspection, it is the position of the Quality Department that the additional crack was not present at the post-1000 thermal cycle inspection point.

TRW maintains that the probability is very high that all cracks in the one cell were caused by a noted defect (a raised area) in the cell and not by an deficiency in the manufacturing process. S. Cabanus of ASEC reviewed the cell on 6/30/95 and indicated that the defect, though not know for certain, was probably a flaw in the germanium substrate.



NSO # QLBASA0040

National Aeronautics and
Space Administration
Goddard Space Flight Center
Greenbelt, MD 20771

Reply to Attn of: 214.3

October 17, 1995

Rec'd 10/25/95

Ms. Pamela Jackson
Sr. Contracts Administrator
TRW Space & Technology Division/Space & Electronics Group
One Space Park
Redondo Beach, CA 90278

SUBJECT: Contract NAS5-32464, Request for Deviations/Waivers W001-Rev. 1 & W004

As previously communicated to TRW verbally, Request for Waiver No. W001-Rev. 1 entitled "Qual Panel Thermal Cycling" is approved. Also, Request for Waiver No. W004 entitled "Fibers in Cell Backside Solder Joint" is approved contingent upon the understanding that TRW will inspect with polarized light and strive to use foam tip swabs and uncut lint free wipes in the cleaning operations to reduce the number of fibers in the solder joints.

The executed forms entitled "Request for Deviation/Waiver (DD Form 1694)" are enclosed. Please call Mr. Joseph Kroener, Contract Specialist, at (301) 286-3294 if you have any questions.

J. Steve Metcalf
Contracting Officer

REQUEST FOR DEVIATION/WAIVER

(See MIL-STD-480 or 481 for instructions)

DATE (YYMMDD): 95/08/14

Form Approved OMB No. 0704-0188

PROCURING ACTIVITY NUMBER:

1. ORIGINATOR NAME AND ADDRESS

TRW Space & Electronics Group

2. ☐ DEVIATION ☒ WAIVER

3. ☐ MINOR ☒ MAJOR ☐ CRITICAL

4. DESIGNATION FOR DEVIATION/WAIVER

a. MODEL TYPE	b. CAGE CODE	c. SYS. DESIG.	d. DEV/WAIVER NO.
	11982		W002

5. BASELINE AFFECTED: ☐ FUNCTIONAL ☐ ALLOCATED ☐ PRODUCT

6. OTHER SYSTEM/ CONFIGURATION ITEMS AFFECTED: ☐ YES ☐ NO Unknown at present

7. SPECIFICATIONS AFFECTED - TEST PLAN

8. DRAWINGS AFFECTED: D828360

	CAGE CODE	SPECIFICATION/DOCUMENT NO.	REV.	CAGE CODE	NUMBER	REV.
a. SYSTEM		TRMM-711-058				
b. ITEM		Section 4.10.9				
c. TEST PLAN						

9. TITLE OF DEVIATION/WAIVER

9.a. WEAPON SYSTEM CODE OR DESIGNATION

10. CONTRACT NO. AND LINE ITEM: NAS 5-32464

11. PROCURING CONTRACTING OFFICER: Joseph Kroener
CODE 284.4 TEL (301) 286-3294

12. CONFIGURATION ITEM NOMENCLATURE: Reverse Bias Test Panel

13. CLASSIFICATION OR DEFECT

a. CD NO.	b. DEFECT NO.	c. DEFECT CLASSIFICATION
		☐ MINOR ☒ MAJOR ☐ CRITICAL

14. NAME OF LOWEST PART/ASSEMBLY AFFECTED: Reverse Bias Test Panel

15. PART NO. OR TYPE DESIGNATION: D828360

16. LOT NO.: N/A

17. QTY: 1

18. RECURRING DEVIATION/WAIVER: ☐ YES ☒ NO

19. EFFECT ON COST/PRICE: N/A

20. EFFECT ON DELIVERY SCHEDULE: N/A

21. EFFECT ON INTEGRATED LOGISTICS SUPPORT, INTERFACE OR SOFTWARE: N/A

22. DESCRIPTION OF DEVIATION/WAIVER

Reference discrepancy report (attached) #RR3769. After cycling 100 cycles at +85°C, 6 cells have degraded beyond the 3% criteria. Note all cells except BT19 passed criteria through 20,000 cycles at -85°C. Disposition agreed to with NASA for this discrepancy is to continue test from cycles #101 through #1000 and re-measure.

23. NEED FOR DEVIATION/WAIVER

Section 4.10.9 Pass/Fail Criteria. The cells shall degrade no more than 3% in peak power.

24. SERIAL NUMBER(S) AFFECTED: N/A

25. SUBMITTING ACTIVITY AUTHORIZED SIGNATURE: Lee Pekarek — Lee C. Pekarek 15 Aug 95

25. a. TITLE: Program Manager

26. APPROVAL/DISAPPROVAL a. ☐ RECOMMEND ☐ APPROVAL ☐ DISAPPROVAL

b. APPROVAL	c. GOVERNMENT ACTIVITY	SIGNATURE	DATE (YYMMDD)
☒ APPROVED ☐ DISAPPROVED	21 Aug 95 Vickie Eakin Mercer		
d. APPROVAL	**e. GOVERNMENT ACTIVITY**	**SIGNATURE**	**DATE (YYMMDD)**
☐ APPROVED ☐ DISAPPROVED			

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Report Number: RR3769

*** DEFECT DESCRIPTION ***
AT OPER. 250 (FORWARD 4 MEASUREMENT) THE FOLLOWING CELLS OUTPUT DECREASE BY MORE THAN 4%
BT3 IS 4.2220, BT6 IS 15.3159, BT12 IS 4.1649, BT14 IS 4.8170, BT15 IS 4.6522 AND BT19 IS 5.8250 ALL S/B 4% OR LESS.

*** DISPOSITION INSTRUCTIONS/REMARKS ***
Use as is. This test is informational and the data shall be used for engineering purposes. The limit designated as 3% maximum loss was used to trigger a close watch on the cells under test by the RDE. Since this has now occured, the procedure for data review will be changed to require Specific RDE review of data after each segment of thermalelectrical cycling. A waiver shall be generated to allow continuance of the test through o the end without additional Discrepancy reports to be written against this output loss defect of any and all cells on the panel.

Disposition: A - MRB Use-As-Is

Approvals for Material Non-Conformance

PR:	Manufacturing: A. Wojtalewicz	QA: L. J. Irwin
	Date: 11-AUG-95	Date: 11-AUG-95
MRB:	Engineering: M. A. Kruer	QA: L. J. Irwin
	Date: 14-AUG-95	Date: 14-AUG-95
	Manufacturing:	Govt:
	Date:	Date:

*** RETEST INSTRUCTIONS ***

*** OVERSTRESS STATEMENT ***
Cause: 9A - Under investigation (TBD)
Responsibility: 03 - S&TD/MS&TPC Unable to Determine/Other
Corrective Action: 9A - Under investigation (interim)

Report Number: RR3769

No. Prior Occurrences: 0
No. Recurrences:

C/A ECD:
C/A Actionee:

*** CAUSE ***
UNDER INVESTIGATION

*** CORRECTIVE ACTION ***
UNDER INVESTIGATION

Total Line Cost: $0

Material Costs: $

*** COST COMMENTS ***

National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland
20771

734.4

August 16th, 1995

Lee Pekarek program manager for TRMM Solar Array NASS-32464
TRW Space and Electronic Group
One Space Park
Redondo Beach, CA 90278

SUBJECT: Disposition of reverse bias test panel.

As per our verbal agreement GSFC approves the TRW intention to replace the TRMM reverse bias panel in the thermal cycling chamber to finish the full thermal cycling testing.

734.4/ Ms. Vickie Moran

cc:
734.4/ Mr. Ed Gaddy
734.4 Richard Stegeman
303 / Paul Frazer
722.2/ Jon Lawrence

National Aeronautics and
Space Administration
Goddard Space Flight Center
Greenbelt, MD 20771

Reply to Attn of 284.4

August 22, 1995

Ms. Pamela Jackson
Sr. Contracts Administrator
TRW Space & Technology Division/Space & Electronics Group
One Space Park
Redondo Beach, CA 90278

SUBJECT: Contract NAS5-32464, Request for Deviations/Waivers W002 & W003

Request for Waiver No. W002 entitled 'Reverse Bias Test Panel" is approved. Request for Deviation No. W003 entitled "Glassing" is approved contingent upon the following conditions:

1) All uncured adhesives must be removed after the back side soldering and prior to panel assembly; and

2) This relaxation of the coverglass void criteria shall not change the final power requirement as called for in the specification.

The executed forms entitled "Request for Deviation/Waiver (DD Form 1694)" are enclosed. Please call Mr. Joseph Kroener, Contract Specialist, at (301) 286-3294 if you have any questions.

J. Steve Metcalf
Contracting Officer

Request for Deviation/Waiver

23. Description of Deviation/Waiver

The new glassing criteria for TRMM cell stacks shall be as follows:

1. Allowable adhesive-free area for any single bubble or void is 2 mm diameter.

2. The total allowable adhesive-free area from allowable bubbles or voids shall be less than or equal to 1% of the total area, or 0.176 cm^2.

3. Bubbles or voids less than 0.2 mm diameter or equivalent area may be disregarded when summing for the total allowable adhesive-free area defined above.

For the cell edges, defined as any area physically in contact with any edge of the cell, the allowable adhesive-free area from voids, bubble, tearouts, or scalloping is 5% of the total cell area, or 0.88 cm^2 subject to the following:

1. Contiguous voids, bubbles, tearouts or scalloping less than 0.2 mm diameter or equivalent area may be disregarded when summing to this total allowable area.

2. Contiguous adhesive-free areas with greater than 1% of the cell area or 0.176 cm^2 shall have the overhanging edge of the glass greater than or equal to 3 mils (or 0.08 mm), overriding the standard glassing allowance.

3. Any uncured adhesive may be left to the next level of assembly, where it will be evaluated after vapor degreasing.

The glassing criteria for module level inspection shall be the same as the cell stack criteria except cell stacks with uncured adhesive after assembly cleaning shall be referred to MRB.

REQUEST FOR DEVIATION/WAIVER

(See MIL-STD-480 or 481 for instructions)

DATE (YYMMDD): 95/09/20

Form Approved
OMB No. 0704-0188

PROCURING ACTIVITY NUMBER

1. ORIGINATOR NAME AND ADDRESS

TRW Space & Electronics Grroup
One Space Park
Redondo Beach, CA 90278

2. [X] DEVIATION [ ] WAIVER

3. [X] MINOR [ ] MAJOR [ ] CRITICAL

4. DESIGNATION FOR DEVIATION/WAIVER

a. MODEL TYPE	b. CAGE CODE	c. SYS. DESIG.	d. DEV/WAIVER NO.
	11982		W004

5. BASELINE AFFECTED [ ] FUNCTIONAL [ ] ALLOCATED [X] PRODUCT

6. OTHER SYSTEM/ CONFIGURATION ITEMS AFFECTED [ ] YES [X] NO

7. SPECIFICATIONS AFFECTED - TEST PLAN

	CAGE CODE	SPECIFICATION/DOCUMENT NO.	REV.
a. SYSTEM		TRMM 711-058	
b. ITEM			
c. TEST PLAN			

8. DRAWINGS AFFECTED

CAGE CODE	NUMBER	REV.

9. TITLE OF DEVIATION/WAIVER
Fibers in Cell Backside Solder Joint

9.a. WEAPON SYSTEM CODE OR DESIGNATION

10. CONTRACT NO. AND LINE ITEM
NAS5-32464

11. PROCURING CONTRACTING OFFICER
CODE | TEL

12. CONFIGURATION ITEM NOMENCLATURE
TRMM Solar Panel Assembly

13. CLASSIFICATION OR DEFECT

a. CD NO.	b. DEFECT NO.	c. DEFECT CLASSIFICATION
		[X] MINOR [ ] MAJOR [ ] CRITICAL

14. NAME OF LOWEST PART/ASSEMBLY AFFECTED
Solar Cell Module Assembly

15. PART NO. OR TYPE DESIGNATION
828340-1 and -2, 828350-1, 828360-1

16. LOT NO.
N/A

17. QTY

18. RECURRING DEVIATION/WAIVER [X] YES [ ] NO

19. EFFECT ON COST/PRICE
N/A

20. EFFECT ON DELIVERY SCHEDULE

21. EFFECT ON INTEGRATED LOGISTICS SUPPORT, INTERFACE OR SOFTWARE
N/A

22. DESCRIPTION OF DEVIATION/WAIVER
Allowance for no more than five (5) fibers total in any interconnect solder joint. No more than one (1) of the five fibers can be located in an inspection hole. Exceeding these limits is cause for rework. Loose fibers shall not be cause for rejection/rework.

23. NEED FOR DEVIATION/WAIVER
Reference Specification Section #3.9.3.5 Interconnect Imperfections.

24. SERIAL NUMBER(S) AFFECTED
N/A

25. SUBMITTING ACTIVITY AUTHORIZED SIGNATURE
L. C. Pekarek

25. a. TITLE
Program Manager

26. APPROVAL/DISAPPROVAL a. RECOMMEND [ ] APPROVAL [ ] DISAPPROVAL

b. APPROVAL	c. GOVERNMENT ACTIVITY	SIGNATURE	DATE (YYMMDD)
[ ] APPROVED [ ] DISAPPROVED			
d. APPROVAL	e. GOVERNMENT ACTIVITY	SIGNATURE	DATE (YYMMDD)
[ ] APPROVED [ ] DISAPPROVED			

DD Form 1694, JUL 88

REQUEST FOR DEVIATION/WAIVER

(See MIL-STD-480 or 481 for Instructions)

DATE (YYMMDD): 96/02/28

Form Approved
OMB No. 0704-0188

PROCURING ACTIVITY NUMBER:

1. ORIGINATOR NAME AND ADDRESS

TRW Space & Electronics Group
One Space Park
Redondo Beach, CA 90278

2. ☐ DEVIATION ☒ WAIVER

3. ☒ MINOR ☐ MAJOR ☐ CRITICAL

4. DESIGNATION FOR DEVIATION/WAIVER

a. MODEL TYPE	b. CAGE CODE	c. SYS. DESIG.	d. DEV/WAIVER NO.
			W005

5. BASELINE AFFECTED
☐ FUNCTIONAL ☐ ALLOCATED ☒ PRODUCT

6. OTHER SYSTEM/ CONFIGURATION ITEMS AFFECTED
☐ YES ☒ NO

7. SPECIFICATIONS AFFECTED - TEST PLAN

	CAGE CODE	SPECIFICATION/DOCUMENT NO.	REV.
a. SYSTEM			
b. ITEM		TRMM-711-058	
c. TEST PLAN			

8. DRAWINGS AFFECTED

CAGE CODE	NUMBER	REV.

9. TITLE OF DEVIATION/WAIVER
Solar Cell Tape Pull Test

9.a. WEAPON SYSTEM CODE OR DESIGNATION

10. CONTRACT NO. AND LINE ITEM
NAS5-32464

11. PROCURING CONTRACTING OFFICER
J. Kroener
CODE 214.3 TEL (301) 286-3294

12. CONFIGURATION ITEM NOMENCLATURE

13. CLASSIFICATION OR DEFECT

a. CD NO.	b. DEFECT NO.	c. DEFECT CLASSIFICATION
		☒ MINOR ☐ MAJOR ☐ CRITICAL

14. NAME OF LOWEST PART/ASSEMBLY AFFECTED
Solar Cell

15. PART NO. OR TYPE DESIGNATION
TRW No. 8Y040-022U-001

16. LOT NO.
All

17. QTY
9248

18. RECURRING DEVIATION/WAIVER
☐ YES ☒ NO

19. EFFECT ON COST/PRICE
None

20. EFFECT ON DELIVERY SCHEDULE
None

21. EFFECT ON INTEGRATED LOGISTICS SUPPORT, INTERFACE OR SOFTWARE
None

22. DESCRIPTION OF DEVIATION/WAIVER
Tape pull test required in Section 4.9.1.2 not performed.

23. NEED FOR DEVIATION/WAIVER
See attached.

24. SERIAL NUMBER(S) AFFECTED
All four solar array panels.

25. SUBMITTING ACTIVITY AUTHORIZED SIGNATURE
Lee C. Pekarek Lee C. Pekarek 1MAR96

25. a. TITLE
Program Manager

26. APPROVAL/DISAPPROVAL: a. RECOMMEND ☐ APPROVAL ☐ DISAPPROVAL

b. APPROVAL	c. GOVERNMENT ACTIVITY	SIGNATURE	DATE (YYMMDD)
☐ APPROVED ☐ DISAPPROVED			
d. APPROVAL	e. GOVERNMENT ACTIVITY	SIGNATURE	DATE (YYMMDD)
☐ APPROVED ☐ DISAPPROVED			

DD Form 1694, JUL 88

Request for Deviation Waiver No. W005 (continued)

23. Need for Deviation/Waiver

- Tape pull test was not performed.
  - This is viewed by contractor as a destructive test which would cause additional cells to be purchased, increasing the contract cost significantly.
  - Waiver of this task was agreed to at the CDR in 1993. A copy of the action items listing submittal of this waiver is attached.

REQUEST FOR DEVIATION/WAIVER

(See MIL-STD-480 or 481 for Instructions)

DATE (YYMMDD): 96/02/28

Form Approved
OMB No. 0704-0188

PROCURING ACTIVITY NUMBER:

1. ORIGINATOR NAME AND ADDRESS

TRW Space & Electronics Group
One Space Park
Redondo Beach, CA 90278

2. [ ] DEVIATION [X] WAIVER

3. [X] MINOR [ ] MAJOR [ ] CRITICAL

4. DESIGNATION FOR DEVIATION/WAIVER

a. MODEL TYPE	b. CAGE CODE	c. SYS. DESIG.	d. DEV/WAIVER NO.
			W006

5. BASELINE AFFECTED: [ ] FUNCTIONAL [ ] ALLOCATED [X] PRODUCT

6. OTHER SYSTEM/CONFIGURATION ITEMS AFFECTED: [ ] YES [X] NO

7. SPECIFICATIONS AFFECTED - TEST PLAN

	CAGE CODE	SPECIFICATION/DOCUMENT NO.	REV.
a. SYSTEM			
b. ITEM		TRMM-711-058	
c. TEST PLAN			

8. DRAWINGS AFFECTED

CAGE CODE	NUMBER	REV.

9. TITLE OF DEVIATION/WAIVER: Solar Cell AR Coating Durability

9.a. WEAPON SYSTEM CODE OR DESIGNATION:

10. CONTRACT NO. AND LINE ITEM: NAS5-32464

11. PROCURING CONTRACTING OFFICER: J. Kroener
CODE 214.3 TEL (301) 286-3294

12. CONFIGURATION ITEM NOMENCLATURE:

13. CLASSIFICATION OR DEFECT

a. CD NO.	b. DEFECT NO.	c. DEFECT CLASSIFICATION
		[X] MINOR [ ] MAJOR [ ] CRITICAL

14. NAME OF LOWEST PART/ASSEMBLY AFFECTED: Solar Cell

15. PART NO. OR TYPE DESIGNATION: TRW No. 8Y040-022U-001

16. LOT NO.: All

17. QTY: 9248

18. RECURRING DEVIATION/WAIVER: [ ] YES [X] NO

19. EFFECT ON COST/PRICE: None

20. EFFECT ON DELIVERY SCHEDULE: None

21. EFFECT ON INTEGRATED LOGISTICS SUPPORT, INTERFACE OR SOFTWARE: None

22. DESCRIPTION OF DEVIATION/WAIVER

Testing of solar cells per Section 4.9.1.3 not performed.

23. NEED FOR DEVIATION/WAIVER

See attached.

24. SERIAL NUMBER(S) AFFECTED

All four solar array panels.

25. SUBMITTING ACTIVITY AUTHORIZED SIGNATURE: Lee C. Pekarek Lee Pekarek 1/11/96

25. a. TITLE: Program Manager

26. APPROVAL/DISAPPROVAL a. RECOMMEND [ ] APPROVAL [ ] DISAPPROVAL

b. APPROVAL	c. GOVERNMENT ACTIVITY	SIGNATURE	DATE (YYMMDD)
[ ] APPROVED [ ] DISAPPROVED			

d. APPROVAL	e. GOVERNMENT ACTIVITY	SIGNATURE	DATE (YYMMDD)
[ ] APPROVED [ ] DISAPPROVED			

DD Form 1694, JUL 88

Request for Deviation Waiver No. W006 (continued)

23. Need for Deviation/Waiver

- Test not performed due to inability of coating to withstand test.
    - On a sample lot submitted to the test, 3/4 of the coating thickness abraded off after rubbing with the eraser.
- Coating did survive the 17,000 thermal cycle qual panel requirement and the 12 cycle flight thermal vacuum requirement. No AR coating degradation observed.

REQUEST FOR DEVIATION/WAIVER

(See MIL-STD-480 or 481 for instructions)

DATE (YYMMDD): 96/02/28

Form Approved
OMB No. 0704-0188

PROCURING ACTIVITY NUMBER

1. ORIGINATOR NAME AND ADDRESS

TRW Space & Electronics Group
One Space Park
Redondo Beach, CA 90278

2. ☐ DEVIATION ☒ WAIVER

3. ☒ MINOR ☐ MAJOR ☐ CRITICAL

4. DESIGNATION FOR DEVIATION/WAIVER

a. MODEL TYPE	b. CAGE CODE	c. SYS. DESIG.	d. DEV/WAIVER NO.
			W007

5. BASELINE AFFECTED: ☐ FUNCTIONAL ☐ ALLOCATED ☒ PRODUCT

6. OTHER SYSTEM/ CONFIGURATION ITEMS AFFECTED: ☐ YES ☒ NO

7. SPECIFICATIONS AFFECTED - TEST PLAN

8. DRAWINGS AFFECTED

	CAGE CODE	SPECIFICATION/DOCUMENT NO.	REV.	CAGE CODE	NUMBER	REV.
a. SYSTEM						
b. ITEM		TRMM-711-058				
c. TEST PLAN						

9. TITLE OF DEVIATION/WAIVER
Solar Cell Absorptance Verification

9.a. WEAPON SYSTEM CODE OR DESIGNATION

10. CONTRACT NO. AND LINE ITEM
NAS5-32464

11. PROCURING CONTRACTING OFFICER
J. Kroener
CODE 214.3 TEL (301) 286-3294

12. CONFIGURATION ITEM NOMENCLATURE

13. CLASSIFICATION OR DEFECT

a. CD NO.	b. DEFECT NO.	c. DEFECT CLASSIFICATION
		☒ MINOR ☐ MAJOR ☐ CRITICAL

14. NAME OF LOWEST PART/ASSEMBLY AFFECTED
Solar Cell

15. PART NO. OR TYPE DESIGNATION
TRW No. 8Y040-022U-001

16. LOT NO.
All

17. QTY
9248

18. RECURRING DEVIATION/WAIVER ☐ YES ☒ NO

19. EFFECT ON COST/PRICE
None

20. EFFECT ON DELIVERY SCHEDULE
None

21. EFFECT ON INTEGRATED LOGISTICS SUPPORT, INTERFACE OR SOFTWARE
None

22. DESCRIPTION OF DEVIATION/WAIVER
Testing of solar cells per Section 4.9.1.4 not performed.

23. NEED FOR DEVIATION/WAIVER
See attached.

24. SERIAL NUMBER(S) AFFECTED
All four solar array panels.

25. SUBMITTING ACTIVITY AUTHORIZED SIGNATURE
Lee C. Pekarek Lee Pekarek 1MAR96

25. a. TITLE
Program Manager

26. APPROVAL/DISAPPROVAL a. RECOMMEND ☐ APPROVAL ☐ DISAPPROVAL

b. APPROVAL	c. GOVERNMENT ACTIVITY	SIGNATURE	DATE (YYMMDD)
☐ APPROVED ☐ DISAPPROVED			
d. APPROVAL ☐ APPROVED ☐ DISAPPROVED	e. GOVERNMENT ACTIVITY	SIGNATURE	DATE (YYMMDD)

DD Form 1694, JUL 88

Request for Deviation Waiver No. W007 (continued)

23. Need for Deviation/Waiver

- Test not performed due to inability to pass test.
  - Sample testing yielded absorptance values of .89-.90 versus a requirement of .87. The .89-.90 values are consistent with the standard values of the ASEC Ge/GaAs cell (TRMM and EOS).

REQUEST FOR DEVIATION/WAIVER

(See MIL-STD-480 or 481 for Instructions)

DATE (YYMMDD): 96/02/28

Form Approved
OMB No. 0704-0188

PROCURING ACTIVITY NUMBER:

1. ORIGINATOR NAME AND ADDRESS
TRW Space & Electronics Group
One Space Park
Redondo Beach, CA 90278

2. [ ] DEVIATION [X] WAIVER

3. [X] MINOR [ ] MAJOR [ ] CRITICAL

4. DESIGNATION FOR DEVIATION/WAIVER

a. MODEL TYPE	b. CAGE CODE	c. SYS. DESIG.	d. DEV/WAIVER NO.
			W008

5. BASELINE AFFECTED
[ ] FUNCTIONAL [ ] ALLOCATED [X] PRODUCT

6. OTHER SYSTEM/ CONFIGURATION ITEMS AFFECTED
[ ] YES [X] NO

7. SPECIFICATIONS AFFECTED - TEST PLAN

	CAGE CODE	SPECIFICATION/DOCUMENT NO.	REV.
a. SYSTEM			
b. ITEM		TRMM-711-058	
c. TEST PLAN			

8. DRAWINGS AFFECTED

CAGE CODE	NUMBER	REV.

9. TITLE OF DEVIATION/WAIVER
Accelerated Humidity Test

9.a. WEAPON SYSTEM CODE OR DESIGNATION

10. CONTRACT NO. AND LINE ITEM
NAS5-32464

11. PROCURING CONTRACTING OFFICER
J. Kroener
CODE 214.3 TEL (301) 286-3294

12. CONFIGURATION ITEM NOMENCLATURE

13. CLASSIFICATION OR DEFECT

a. CD NO.	b. DEFECT NO.	c. DEFECT CLASSIFICATION
		[X] MINOR [ ] MAJOR [ ] CRITICAL

14. NAME OF LOWEST PART/ASSEMBLY AFFECTED
Solar Cell

15. PART NO. OR TYPE DESIGNATION
TRW No. 8Y040-022U-001

16. LOT NO.
Various

17. QTY
Approx. 7700

18. RECURRING DEVIATION/WAIVER
[ ] YES [X] NO

19. EFFECT ON COST/PRICE
None

20. EFFECT ON DELIVERY SCHEDULE
None

21. EFFECT ON INTEGRATED LOGISTICS SUPPORT, INTERFACE OR SOFTWARE
None

22. DESCRIPTION OF DEVIATION/WAIVER
Accelerated humidity test per Section 4.1.0.1 not performed on all contact evaporation lots.

23. NEED FOR DEVIATION/WAIVER
See attached.

24. SERIAL NUMBER(S) AFFECTED
All four solar array panels.

25. SUBMITTING ACTIVITY AUTHORIZED SIGNATURE
Lee C. Pekarek Lee C. Pekarek 1MAR96

25. a. TITLE
Program Manager

26. APPROVAL/DISAPPROVAL a. RECOMMEND [ ] APPROVAL [ ] DISAPPROVAL

b. APPROVAL	c. GOVERNMENT ACTIVITY	SIGNATURE	DATE (YYMMDD)
[ ] APPROVED [ ] DISAPPROVED			
d. APPROVAL	e. GOVERNMENT ACTIVITY	SIGNATURE	DATE (YYMMDD)
[ ] APPROVED [ ] DISAPPROVED			

DD Form 1694, JUL 88

Request for Deviation Waiver No. W008 (continued)

23. Need for Deviation/Waiver

- Accelerated humidity test was not performed on approximately 85% of the evaporation lots.
  - Existing project manager and lead engineer thought requirement was negotiated out. No written evidence to support this position exists. Original project manager has left TRW.
  - Humidity test being performed as follows as agreed to with E. Gaddy of NASA.
    - Two cells each from 7 evaporation lots (14 cells total) from the 1100 cell shipment received for ASEC 1/96 will be interconnected and submitted into the 30-day test.
    - Two cells from the previous 10,000 cell shipments will be interconnected and submitted into the 30-day test.

REQUEST FOR DEVIATION/WAIVER

(See MIL-STD-480 or 481 for instructions)

DATE (YYMMDD)	Form Approved OMB
96/07/16	No. 0704-0188

PROCURING ACTIVITY NUMBER

1. ORIGINATOR NAME AND ADDRESS
TRW Space & Electronics Group
One Space Park
Redondo Beach, CA 90278

2. [X] DEVIATION [ ] WAIVER

3. [X] MINOR [ ] MAJOR [ ] CRITICAL

4. DESIGNATION FOR DEVIATION/WAIVER

a. MODEL TYPE	b. CAGE CODE	c. SYS. DESIG.	d. DEV/WAIVER NO.
	11982		D002

5. BASELINE AFFECTED
[ ] FUNCTIONAL [ ] ALLOCATED [X] PRODUCT

6. OTHER SYSTEM/CONFIGURATION ITEMS AFFECTED
[ ] YES [ ] NO

7. SPECIFICATIONS AFFECTED - TEST PLAN

	CAGE CODE	SPECIFICATION/DOCUMENT NO.	REV.
a. SYSTEM		TRMM 711-058	
b. ITEM			
c. TEST PLAN			

8. DRAWINGS AFFECTED

CAGE CODE	NUMBER	REV.

9. TITLE OF DEVIATION/WAIVER
Center of Mass Deviation

9.a. WEAPON SYSTEM CODE OR DESIGNATION

10. CONTRACT NO. AND LINE ITEM
NAS5-32464

11. PROCURING CONTRACTING OFFICER
CODE | TEL

12. CONFIGURATION ITEM NOMENCLATURE
TRMM Solar Panel Assemblies

13. CLASSIFICATION OR DEFECT

a. CD NO.	b. DEFECT NO.	c. DEFECT CLASSIFICATION
		[X] MINOR [ ] MAJOR [ ] CRITICAL

14. NAME OF LOWEST PART/ASSEMBLY AFFECTED
Solar Panel

15. PART NO. OR TYPE DESIGNATION
828350-1, 828360-1

16. LOT NO.
N/A

17. QTY
N/A

18. RECURRING DEVIATION/WAIVER
[ ] YES [X] NO

19. EFFECT ON COST/PRICE
N/A

20. EFFECT ON DELIVERY SCHEDULE
N/A

21. EFFECT ON INTEGRATED LOGISTICS SUPPORT, INTERFACE OR SOFTWARE
N/A

22. DESCRIPTION OF DEVIATION/WAIVER
Center of mass for in board panels is within 7.64cm versus 2.5cm requirement.
See Section 3.5 of final verification matrix for CG measurements,
7.64cm = sq. root (107.95 - 101.24) ^{2} + (110.49 - 106.83) ^{2}.

23. NEED FOR DEVIATION/WAIVER
Center of mass of the two in board panels (+ Y and - Y) does not fall within the prescribed 2.5cm of each other per paragraphs 3.5 and 4.5.

24. SERIAL NUMBER(S) AFFECTED
828350-1 and 828360-1

25. SUBMITTING ACTIVITY AUTHORIZED SIGNATURE
L.C. Pekarek L.C. Pekarek 7/17/96

25. a. TITLE
Program Manager

26. APPROVAL/DISAPPROVAL a. RECOMMEND [ ] APPROVAL [ ] DISAPPROVAL

b. APPROVAL	c. GOVERNMENT ACTIVITY	SIGNATURE	DATE (YYMMDD)
[ ] APPROVED [ ] DISAPPROVED			
d. APPROVAL	**e. GOVERNMENT ACTIVITY**	**SIGNATURE**	**DATE (YYMMDD)**
[ ] APPROVED [ ] DISAPPROVED			

DD Form 1694, JUL 88

REQUEST FOR DEVIATION/WAIVER

(See MIL-STD-480 or 481 for instructions)

DATE (YYMMDD): 96/07/16

Form Approved OMB No. 0704-0188

PROCURING ACTIVITY NUMBER:

1. ORIGINATOR NAME AND ADDRESS
TRW Space & Electronics Group
One Space Park
Redondo Beach, CA 90278

2. [X] DEVIATION [ ] WAIVER

3. [X] MINOR [ ] MAJOR [ ] CRITICAL

4. DESIGNATION FOR DEVIATION/WAIVER

a. MODEL TYPE	b. CAGE CODE	c. SYS. DESIG.	d. DEV/WAIVER NO.
	11982		D003

5. BASELINE AFFECTED
[ ] FUNCTIONAL [ ] ALLOCATED
[X] PRODUCT

6. OTHER SYSTEM/CONFIGURATION ITEMS AFFECTED
[ ] YES [ ] NO

7. SPECIFICATIONS AFFECTED - TEST PLAN

	CAGE CODE	SPECIFICATION/DOCUMENT NO.	REV.
a. SYSTEM		TRMM 711-058	
b. ITEM			
c. TEST PLAN			

8. DRAWINGS AFFECTED

CAGE CODE	NUMBER	REV.

9. TITLE OF DEVIATION/WAIVER
Post T/V Broken Cell Quantity

9.a. WEAPON SYSTEM CODE OR DESIGNATION

10. CONTRACT NO. AND LINE ITEM
NAS5-32464

11. PROCURING CONTRACTING OFFICER
CODE | TEL

12. CONFIGURATION ITEM NOMENCLATURE
TRMM Solar Panel

13. CLASSIFICATION OR DEFECT

a. CD NO.	b. DEFECT NO.	c. DEFECT CLASSIFICATION
		[X] MINOR [ ] MAJOR [ ] CRITICAL

14. NAME OF LOWEST PART/ASSEMBLY AFFECTED
Solar Panel

15. PART NO. OR TYPE DESIGNATION
828340-1

16. LOT NO.
N/A

17. QTY
1

18. RECURRING DEVIATION/WAIVER
[ ] YES [X] NO

19. EFFECT ON COST/PRICE
N/A

20. EFFECT ON DELIVERY SCHEDULE
N/A

21. EFFECT ON INTEGRATED LOGISTICS SUPPORT, INTERFACE OR SOFTWARE
N/A

22. DESCRIPTION OF DEVIATION/WAIVER
+Y Outboard Panel experienced 56 cracked cells after thermal vacuum test.
All cracked cells were subsequently replaced.

23. NEED FOR DEVIATION/WAIVER
Section 3.10.4.2 limits number of cracked cells caused by thermal vacuum to 46.
Note: However total cracked cells on the panel were 100 total, versus an allowance of 138 total.

24. SERIAL NUMBER(S) AFFECTED
828340-1

25. SUBMITTING ACTIVITY AUTHORIZED SIGNATURE
L.C. Pekarek L. C. Pekarek 7/17/96

25. a. TITLE
Program Manager

26. APPROVAL/DISAPPROVAL a. RECOMMEND [ ] APPROVAL [ ] DISAPPROVAL

b. APPROVAL	c. GOVERNMENT ACTIVITY	SIGNATURE	DATE (YYMMDD)
[ ] APPROVED [ ] DISAPPROVED			
d. APPROVAL	e. GOVERNMENT ACTIVITY	SIGNATURE	DATE (YYMMDD)
[ ] APPROVED [ ] DISAPPROVED			

DD Form 1694, JUL 88

Requirements vs. Verification

Requirement Paragraph	Title	Requirement (from TRMM-711-058)	Verification Paragraph		Verification Technique
3.1	**Configuration**	**Title**	**4.1**		**Title**
3.1.1	**Solar array System Configuration**	**Title**	**4.1.1**		**Title**
3.1.1.1	Panel Identification	Inspect to requirements of Drawings	4.1.1.1	I	PM-14A-001, Para. 3.4.2 and TRW Drawings 828340, 828350, 828360
3.1.1.2	Substrates (GFE)	Inspect to GSFC Drawings	4.1.1.2	I	Receiving QA Inspection
3.1.1.3	Solar array Harnessing	Title	4.1.1.3	I	Manufacturing Readiness Review,
3.1.1.3.1	Component Harnessing				PM-14A-001, Para. 3.8
3.1.1.3.2	Interpanel Harnessing	**Include continuity through harnesses**			Part # — Continuity Test MSO #'s 828383-1 PLBBHAO390, 828383-2 PLBBHAO400, 828385-1 PLBBHAO410, 828387-1 PLBBHAO420, 828387-2 PLBBHAO430, 828389-1 PLBBHAO440
3.1.1.3.3	Array to Observatory Harnessing				GSFC analysis
3.1.2	**Solar Array Panel Configuration**	**Cells to be laid in series as shown.** **No circuit more than 106.5 cm length.** **94% of circuits shall lie outside shadowed zone.**	**4.1.2**	I	Cells meet series direction requirement. All circuits except 3 on -Y inner and 1 on each of + and - Y outer less than 71 cm length. 91% lie completely outside, 6% are obscured 9%, 1 obscured 100%, total unshadowed area = 96.5%. GSFC approved all Drawings
3.1.2.1	Wiring	Title	4.1.2.1		
3.1.2.1.1	String Wiring	Wiring to be as shown in figure 12		I, T	RDE and Product Design review , PM-14A-001, Para. 3.4.2 and TRW Drawings 828340, 828350, 828360 PM-14A-001, para 3.8

3.1.2.1.2	Panel Wiring	Wiring to be as shown in figures 13 and 14		I, T	RDE and Product Design review , PM-14A-001, Para. 3.4.2 and TRW Drawings 828340, 828350, 828360 PM-14A-001, para 3.8
3.1.2.1.3	Qualification Panel Wiring				N/A this review
3.1.2.1.4	Test Panel Wiring				N/A this review
3.1.2.2	Component Layout	Title	4.1.2.2		
3.1.2.2.1	Cell Side Configuration	Title			
3.1.2.2.1.1	Flight Panel Cell Side Configuration	Meet figures 15 and 16 conceptually		I	RDE and Product Design review , PM-14A-001, Para. 3.4.2 and TRW Drawings 828340, 828350, 828360
3.1.2.2.1.2	Qualification Panel Cell Side Wiring				N/A this review
3.1.2.2.1.3	Test Panel Cell Side Wiring				N/A this review
3.1.2.2.1.4	Cell Side Component Clearances	All components extend less than 6mm above panel cell side surface		I	RDE and Product Design review , PM-14A-001, Para. 3.4.2 and TRW Drawings 828340, 828350, 828360, notes 21 and 22.
3.1.2.2.2	Rear Components Layouts	Title		I	RDE and Product Design review , PM-14A-001, Para. 3.4.2 and TRW Drawings 828340, 828350, 828360
3.1.2.2.2.1	Flight Panels	Rear layouts to meet GD1514119 and GD1514120. All components to be bonded to facesheet		I	RDE and Product Design review , PM-14A-001, Para. 3.4.2 and TRW Drawings 828340, 828350, 828360
3.1.2.2.2.2	Qualification Panel Rear Layout				N/A this review
3.1.2.2.2.3	Rear Component Clearances	All components extend less than 5.7mm above panel except terminal boards(TB), diode boards (DB), and connector assemblies(CA). Positions of TB, DB and CA shall not intersect back to back folding of inner to outer panel together		I	RDE and Product Design review , PM-14A-001, Para. 3.4.2 and TRW Drawings 828340, 828350, 828360, notes 21, 22, and 26.

3.2	**Power**	Voc<125V @ BOL, Vpm>48V @ EOL	**4.2**	**A**	GSFC analysis
3.2.1	**Power Output Under Test Conditions**	**Title**	**4.2.1**		
3.2.1.1	Flight Panel BOL Current-Voltage Output	a) Each panel > 978.6W @ 58.9V Total power = 3914.4 W Measured at Connector (828430) or Diode Board anodes (828350, 828360) No anomalous readings caused by defects allowed. b) Verify measurement is same through redundent paths. c) Corrected and uncorrected data to be made available. d) Measure spectral response of the standard and one cell from the first, middle, and last lot of flight cells.		**T**	PM-14A-001, para. 3.6 **+O power = 1014 W** **+I power = 960 W** **-O power = 971 W** **-I power = 1022 W** **Total delivered power = 3967W** b) PM-14A-001 para. 3.6.3.2 c) Data Available d) Submitted Waiver
3.2.1.2	Qualification Panel BOL Current-Voltage Output				N/A this review
3.2.2	**End-of-Life (EOL) Electrical Power Output for Flight Panels**	Supply I-V predictions for end of life Expected 3311.6 W	**4.2.2**	**A**	**Performed at CDA,(predicted 827.9W/panel) revised as follows:** **+O power =860 W @ 51.8 V** **+I power = 811 W @ 51.8 V** **-O power = 812 W @ 51.8 V** **-I power = 854 W @ 51.8 V** **TOTAL = 3337 W**
3.3	**Circuit Insulation**	> 100 Megohms shall be maintained between each circuit and the aluminum substrate. a) Measure resistance of dielectric prior to laydown b) Measure resistance after laydown	**4.3**	**T**	a) MSO #'s PLBBSA0100, PLBBSA0080 Met requirements. b) PM-14A-001, para 3.7 +O 1100 MΩ +I 2000 MΩ -O 1200 MΩ - I 1200 MΩ

3.4	**Weight**	Maximum add on electrical weights: **+0 kg = 8.38 (18.47 lbs.)** **+I kg = 8.17 (18.01 lbs.)** **-0 kg = 8.36 (18.43 lbs.)** **-I kg = 8.76 (19.31 lbs.)**	4.4	T	Actual add on PVA weights: (PM-14A-001, para. 3.10) **+0 kg = 8.31 (18.30 lbs.)** **+I kg = 8.43 (18.59 lbs.)** **-0 kg = 7.88 (17.38 lbs.)** **-I kg = 8.41 (18.55 lbs.)** **Margin of 0.64 kg**
3.5	**Center of Mass**	Center fo Gravity (CG) of +O to be within 2.5 cm of CG of -O, CG of +I to be within 2.5 cm of -I	4.5	T	**PM-14A-001, para 3.10.3** **CG's measured as follows: (top, right side)** **+0 =108.23 cm, 106.73 cm** **+I =107.95 cm, 110.49 cm** **-0 = 104.75 cm, 106.98 cm** **-I = 101.24 cm, 106.83 cm** **Waiver to be submitted for inner panels**
3.6	**Magnetic Field**	a) Supply certificate of conformance for Magnetic materials weight. ≤ 500 grams kovar allowed b) minimize stray magnetic field through configuration c) Analyze stray magnetic field. ≤ 3 milligauss at spectrometers	4.6	C I A	a) Supplied at CDA ≤ 300 grams Kovar used b) Inspection of TRW Drawings 828340, 828350, 828360 c) Data provided at CDA
3.7	**Cleanliness and Contamination Control**	a) Visual inspection for Cleanliness b) Bakout panels per 4.7. Use TQCM to verify < 330Hz/hour	4.7	I	a) Inspection and Cleaning per D21814, PM-14A-001, para 3.4, and D21816. Wipes for analysis performed between cleaning and packaging. b) PM-14A-001, para.3.12 28 Hz/hour achieved
3.8	**Reliability**	High reliability Perform FMEA	4.8	A	**FMEA submitted at CDA**
3.9	**Component and Sub-assembly**	**Title**	4.9		**Title**

	Requirements				

3.9.1	Solar Cells	Title	4.9.1		Title
3.9.1.1	Solar Cell Type	GaAs/Ge	4.9.1.1		covered per Specification 8Y040
3.9.1.2	Solar Cell Contacts and Grids	Vacuum deposited	4.9.1.2		covered per Specification 8Y040
3.9.1.3	Solar Cell Antireflective Coating	Multi layer AR, with good adherence	4.9.1.3		covered per Specification 8Y040
3.9.1.4	Solar Cell Absorptance	$\alpha \leq 0.87$	4.9.1.4		$\alpha \leq 0.89$
3.9.1.5	Solar Cell Dimensions and Weight	Dimensions specified	4.9.1.5		Alternate size used to meet manufacturer minimum cost covered per Specification 8Y040
3.9.1.6	Solar Cell Electrical Performance	Vmax $\geq$ 870 mV BOL Pmax $\geq$ 24.8 mW/cm^2 (18.33% η)	4.9.1.6		covered per Specification 8Y040 (Note: vendor indicated that Pmax<.870 V, verified) Cell output required only 18.1% η to meet requirements
3.9.1.7	Solar Cell Matching	Match cell outputs to meet electrical requirements			Per drawing instructions, TRW Drawings 828340, 828350, 828360
3.9.1.8	Solar Cell Bonding	Bond using CV1-1142, 90% coverage, 5 mils thickness	4.9.1.7		Per PM-14A-001, para. 3.5. 5 mils minimum thickness shown as not required per qualification board test.
3.9.1.9	Solar Cell Imperfections	as listed	4.9.1.8		Per PM-14A-001, para.3.4, and D21816
3.9.2	**Coverglass**	Cover required	**4.9.2**		**Title**
3.9.2.1	Coverglass Material	Cerium dioxide doped glass	4.9.2.1		covered per Specification 8Y127
3.9.2.2	Coverglass Dimensions	6 mil thickness, overhang all cell sides	4.9.2.2		covered per Specification 8Y127
3.9.2.3	Coverglass Coating	AR coating with UV reflector	4.9.2.3		covered per Specification 8Y127
3.9.2.4	Coverglass Emittance	Normal emittance >0.84	4.9.2.4		covered per Specification 8Y127
3.9.2.5	Coverglass Orientation	Oriented with etched triangle, edges to be even with or overlap cell edges	4.9.2.5		covered per Specification 8Y127. Orientation mark is ink stain on cover edge in lieu of etched triangle.
3.9.2.6	Coverglass Bonding	Use CV4-2500. Bonding imperfections as stated.	4.9.2.6		Per drawing instructions, TRW Drawings 828340, 828350, 828360. Verified per PM-14A-

					001, para.3.4, and D21816
3.9.2.7	Coverglass Imperfections	as listed	4.9.2.7		Per PM-14A-001, para.3.4, and D21816

3.9.3	**Interconnect**	**Title**	**4.9.3**		**Title**
3.9.3.1	Interconnect Material	Contractor to propose.	4.9.3.1		Materials list, TRW Drawings 828340, 828350, 828360
3.9.3.2	Interconnect Design	Contractor shall propose. One connection per 3 cm^2 and one connection per cm of cell p-contact length	4.9.3.2		TRW used one per 4.4cm^2 and one connection per 1.1 cm cell p-contact length. Verified per PM-14A-001, para. 3.4, and D21816
3.9.3.3	Interconnect Soldering	Use Sn62 soldered per NHB-5300.4 (3A-2)	4.9.3.3		Materials list, TRW Drawings 828340, 828350, 828360. Verified per PM-14A-001, para.3.4, and D21816
3.9.3.4	Interconnect Welding		4.9.3.4		N/A
3.9.3.5	Interconnect Imperfections	As listed	4.9.3.5		Veriofied per PM-14A-001, para.3.4, and D21816
3.9.4	**Wiring**	Wiring meet MIL-P-11268	**4.9.4**		
3.9.4.1	Wire Type	TFE insulated 20, 22, and 26 AWG wire per Mil-W-22759/11	4.9.4.1		Materials list, TRW Drawings 828340, 828350, 828360
3.9.4.2	Wire Soldering	soldered per NHB-5300.4 (3A-2)	4.9.4.2		Drawing notes, TRW Drawings 828340, 828350, 828360, Verified per PM-14A-001, para.3.4, and D21816
3.9.4.3	Wire Layout	use twisted pair wire and bond every 8 cm length	4.9.4.3		Layout, TRW Drawings 828340, 828350, 828360. Verified per PM-14A-001, para.3.4, and D21816
3.9.4.4	Wire Bonding	Contractor proposed	4.9.4.4		Used CV-1142. Verified per PM-14A-001, para. 3.4, and D21816
3.9.4.5	Wire Imperfections	As listed	4.9.4.5		Per PM-14A-001, para.3.4 and 3.8, and D21816
3.9.5	**Connectors**	**Title**	**4.9.5**		**Title**
3.9.5.1	Connector Type	As listed	4.9.5.1		Materials list, TRW Drawings 828340, 828350, 828360, Verified per PM-14A-001, para.3.4, and D21816
3.9.5.2	Connector Mounting	Bonded to substrate, electrically conductive at < 20 milliohms to	4.9.5.2		Per PM-14A-001, para.3.4 and 3.8.2, and D21816

		facesheet			
3.9.5.3	Connector Savers	Use	4.9.5.3		Per PM-14A-001, para.3.4, and D21816
3.9.5.4	Connector Bakeout	Bakeout 8 hours at 125C in vacuum.			Drawing notes, TRW Drawings 828340, 828350, 828360

3.9.6	**Terminal Boards**	**Title**	**4.9.6**		
3.9.6.1	Diode Type	Use JANTXV 1N5811 $V_f \leq 0.925$ V at I_L $I_R \leq 5$mA at maximum V_{oc}	4.9.6.1		Parts list and drawing notes, TRW Drawings 828340, 828350, 828360. Verified per PM-14A-001, para.3.4 and 3.9, and D21816
3.9.6.2	Diode Configuration	Mount between two terminal posts with stress relief. Post to body distance $\leq$ 1cm. Solder per NHB-5300.4(3A)	4.9.6.2		Drawing notes, TRW Drawings 828340, 828350, 828360, Verified per PM-14A-001, para.3.4, and D21816
3.9.6.3	Diode Terminal Board Layout	Contractor designed. Insulated from rear facesheet.	4.9.6.3		Drawing notes, TRW Drawings 828340, 828350, 828360, Verified per PM-14A-001, para.3.4, and D21816
3.9.7	**Thermistors**	**Title**	**4.9.7**		**Title**
3.9.7.1	Thermistor Type	YSI 44907. 10,000 ohm $\pm$ 1% at 25°C	4.9.7.1		Materials list, TRW Drawings 828340, 828350, 828360 verified per PM-14A-001, para 3.8.3
3.9.7.2	Thermistor Mounting	Bond 2 thermistors on back of front facesheet. Solder leads to terminal strip on back facesheet. Bond strip with approved adhesive	4.9.7.2		TRW Drawings 828340, 828350, 828360
3.10	**Environmental Requirements**	**Title**	**4.10**		**Title**
3.10.1	**Storage Temperature and Humidity**	Meet requirements after specified storage and transportation. a) Humidity Test one cell from each contact evaporation lot with $\leq$ 1.5% power loss	**4.10.1**	C, T	Basis for certification provided at CDA. a) Humidity test performed on last available lot samples. Deviation approval required.
3.10.2	**Minor Accidental Damage**	Broken and/or malfunctioning parts must be replaceable and meet all other requirements	**4.10.2**	T	Panels are reworkable and have been reworked.

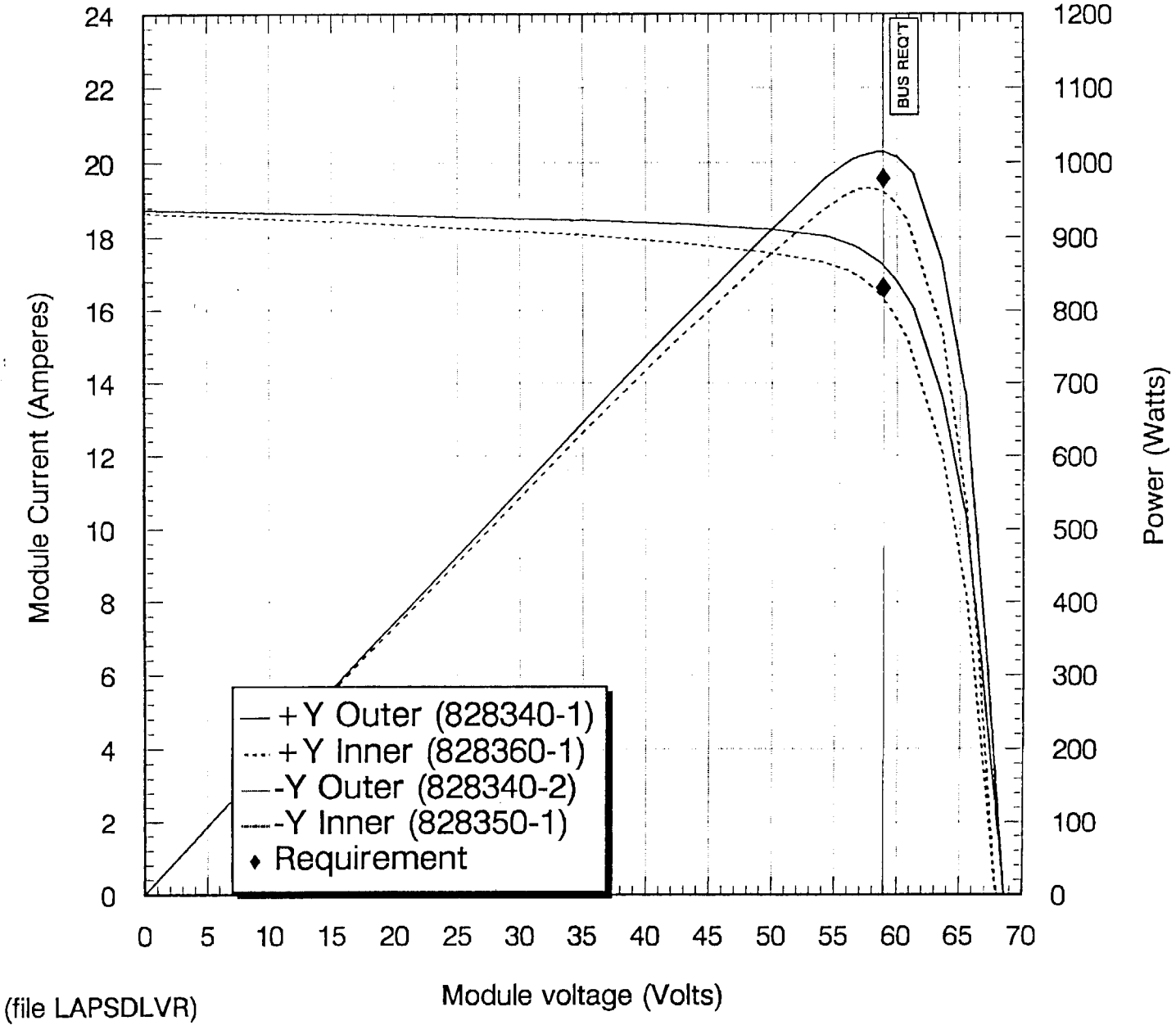
3.10.3	**Acoustic Noise**	**Title**	**4.10.3**		
3.10.3.1	Qualification Panel			T	N/A this review
3.10.3.2	Flight Panels	Suspend panels with natural frequeny ≤ 25 Hz Expose to Environment of Table 7 TRMM-711-058 a) ≤ 92 acceptable cracks allowed b) no measurable degradation of any string		T I T	Test results per PM-14A-001, paragraphs 3.11 and 4.3 a) No acceptable cracks found b) No string with power loss >1% (test repeatability error)
3.10.4	**Thermal**	**Title**	**4.10.4**		
3.10.4.1	Qualification Panel (T/C)			T	N/A this review
3.10.4.2	Flight Panel (T/V)	12 cycles, +90C to -88C. a) Degradation shall be within allowances to meet requirements of 3.2.1.1 b) No continuity failures. c) ≤46 acceptable cracks allowed		T	Test results per PM-14A-001, paragraphs 3.12.3 and 4.5\ a) < 2% 828340-1, < 1% 828360-1, 0% 828340-2, 0% 828350-1 Total Delivered Power = 3967 Watts @ 58.9V b) No continuity failures c) Total Cracks after TV = no acceptable cracks
3.10.5	**Ultraviolet Radiation**	Degradation ≤ 2.4% power	**4.10.5**	T, S	Submitted similarity test data at CDA
3.10.6	**Charged Particle Radiation**	Degradation allowances: ≤ 0.3% Isc; ≤ 0.2% Voc ≤ 0.5% Pmp; ≤ 0.2% Vmp	**4.10.6**	A, S	**Submitted vendor qualification by similarity data for cells at CDA**
3.10.7	**Atomic Oxygen**	Array shall degrade <1% due to Atox	**4.10.7**	A, S	Analysis submitted at CDA, Incorporated provisions of 8.1, Compton GRO similarity
3.10.8	**Micrometeoroids and**	Show negligible degradation at 3.5 years	**4.10.8**	A	Submitted at CDA

	Space Debris				

3.10.9	**Shadowing**	a) RBT all cells per 7.1 b) RBT 10 cells @ low and high temperature, <3% degradation @ Pmax c) Shadow Test full string, 28C and 80C	**4.10.9**	T T T	a) per 7.1 b) Reverse Bias Test Panel, 20 cells 17 Cells did not meet Requirement c) Shadow test of MVP Panel, Data Available
	Order of tests, Qualification		**4.10.10**	I	**N/A this Review**
	Order of tests, Flight		**4.10.11**	I	PM-14A-001, Section 3.1 and Section 4
	Order of tests, Test Panel		**4.10.12**	I	**N/A this Review**
5.1	**Packaging**	Install protective covers on each panel, two panels per container ("+" or "-"), two containers		I	Each panel will be double bagged with inner nylon anti static bag and polyethylene anti static outer bag. Dessicant mounted between bags. Back filled with dry nitrogen and heat sealed. Design reviewed with NASA (J. Lawrence)
5.2	**Marking**	per MIL-STD-129		I	Bar coding not used. Panels will be directly shipped to NASA GSFC. Commercial labeling utilized. Verified with NASA reps.
5.3	**Handling and Transportation**	Handle per Hardpoints of GD1514203 and GD1514205		I	TRMM MGSE. Hard points will be used in container design. Transportation method (TBD) will be coordinated with GSFC
6.0	**Testing of Methods for Atox Protection**	**Title**		I	**N/A this Review**
7.0	**Reverse Bias Testing**				

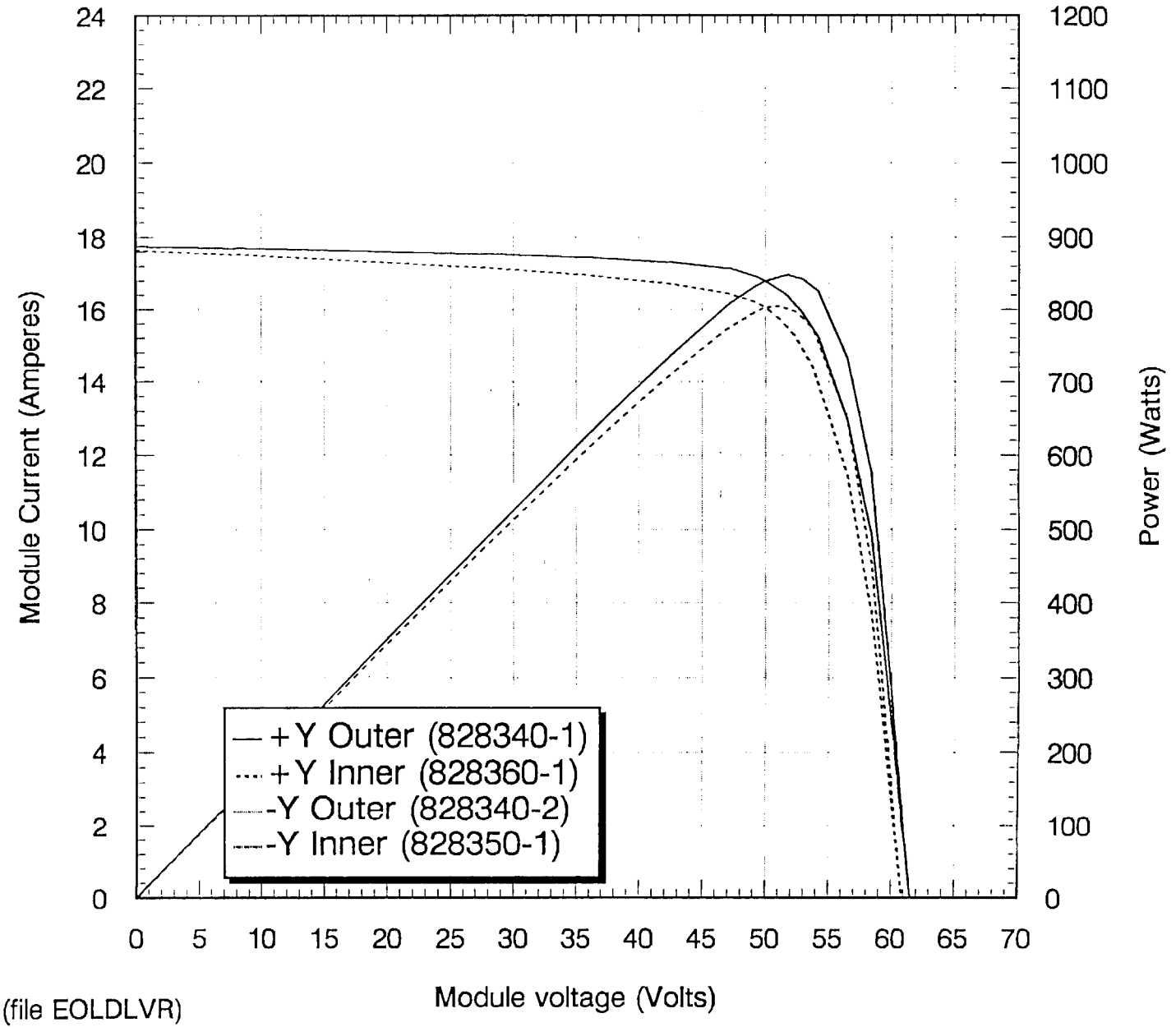
7.1	**Requirements**	Reverse Bias cells to 1.1 Isc, Document # screened and # passed	**7.2**	**T**	Performed per Subcontract # HD6790GG3S, PID 92-1764 paragraph 3.2.2.2
8.0	**Incorporation of Methods to Protect Against Atomic Oxygen Erosion of the Solar Array Harnesses on the Flight Panels**				
8.1	**Requirements**	Implement 10, 11, 12 of Table 9 of TRMM-711-058	**8.2**	**I**	PM-14A-001, Para. 3.4.2 and TRW Drawings 828340, 828350, 828360

Delivered Solar Panel Outputs for TRMM (LAPSS Conditions) compared to prediction



(file LAPSDLVR)

TRMM Measured Solar Panel Outputs adjusted for EOL conditions



(file EOLDLVR)

Panel 360-1 Post Thermal Vacuum

1	55.6923
2	54.0466
3	58.4195
4	55.2493
5	55.3366
6	57.4283
7	55.1702
8	58.4765
9	57.6619
10	54.2787
11	62.6833
12	61.6815
13	52.3611
14	55.9995
15	59.2455
16	53.9877
17	62.5880
	970.3066
line item	output at
x	58.9
	volts

Panel 340-1 Post Thermal Vacuum

1	59.8952
2	62.1505
3	61.8467
4	59.7688
5	58.9744
6	61.0276
7	61.1543
8	61.0867
9	59.9870
10	60.5671
11	58.5110
12	61.2658
13	60.0648
14	61.0286
15	60.6844
16	60.3578
17	60.6158
x	1028.9863
line item	output at
x	58.9
x	volts

STRING GROUP

CURRENT

IV BOL

IV EOL PROJECTED

	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT
1	1	0.9455	x	68.21412	0.007	0.332849	0.49%	0.477499	61.12562	0.006635	0.405572
2	2	0.9176	x	65.41824	9.1693	0.06454	0.10%	599.8394	58.33533	8.691253	507.0071
3	3	0.9918	x	63.52824	12.6954	0.06044	0.10%	806.5164	56.44911	12.03352	679.2814
4	4	0.9380	x	60.61353	15.6076	0.300498	0.50%	946.0317	53.54023	14.79389	792.0682
5	5	0.9395	x	59.91529	15.9999	0.060634	0.10%	958.6387	52.8434	15.16574	801.409
6	6	0.9750	x	59.26235	16.34242	0.265507	0.45%	968.4905	52.19176	15.4904	808.4713
7	7	0.9367	x	58.9	16.4770	0.0986	0.0017	970.4836	51.83013	15.6436	810.7961
8	8	0.9928	x	58.81765	16.50757	0.060676	0.10%	970.9366	51.74794	15.67839	811.3245
9	9	0.9790	x	57.87118	16.8386	0.283679	0.49%	974.4696	50.80337	15.99279	812.4876
10	10	0.9215	x	56.93059	17.0532	0.05984	0.11%	970.8487	49.86466	16.19661	807.6385
11	11	1.0642	x	55.80941	17.2186	0.275419	0.49%	960.9599	48.74572	16.3537	797.1731
12	12	1.0472	x	53.72765	17.4118	0.261833	0.49%	935.495	46.66812	16.5372	771.7601
13	13	0.8890	x	48.89529	17.6728	0.248347	0.51%	864.1168	41.84544	16.78509	702.3794
14	14	0.9508	x	41.99941	17.9283	0.198761	0.47%	752.9781	34.96334	17.02776	595.3473
15	15	1.0059	x	34.43118	18.129	0.165563	0.48%	624.2028	27.41025	17.21837	471.9599
16	16	0.9166	x	14.95294	18.518	0.018291	0.12%	276.8986	7.970967	17.58783	140.1921
17	17	1.0626	x	-0.47376	18.697	0.060307	-12.73%	-8.85798	-7.42489	17.75784	-131.85
18	x	16.4738	x	Vave	Suml	Vstdev	Vstdv%	power	V corr	Icorrr	Pcorr
19	line item	output at	x								
20	x	58.9	x								
21		volts	x								

	STRING GROUP CURRENT		IV BOL					IV EOL PROJECTED		
1	1.0169	x	68.76765	0.0124	0.085186	0.12%	0.8527188	61.67804	0.011754	0.724934
2	1.0552	x	65.45235	11.0005	0.055625	0.08%	720.00861	58.36938	10.42698	608.6165
3	1.0500	x	63.56176	14.2705	0.052943	0.08%	907.05816	56.48257	13.5265	764.0115
4	1.0148	x	61.14118	16.4975	0.086305	0.14%	1008.6766	54.06683	15.63739	845.4642
5	1.0013	x	59.94412	17.091	0.050628	0.08%	1024.5049	52.87216	16.19995	856.5264
6	1.0361	x	59.75765	17.1817	0.082426	0.14%	1026.738	52.68606	16.28592	858.0411
7	1.0383	x	58.9	17.4698	0.0459	0.0008	1028.9581	51.83013	16.5905	859.8749
8	1.0371	x	58.85118	17.48622	0.043858	0.07%	1029.0845	51.78141	16.60788	859.9793
9	1.0185	x	58.37176	17.64	0.085603	0.15%	1029.6779	51.30295	16.75394	859.5264
10	1.0283	x	56.96647	17.92	0.04782	0.08%	1020.8392	49.90047	17.01987	849.2996
11	0.9934	x	56.29529	18.034	0.084935	0.15%	1015.2293	49.23064	17.12815	843.2295
12	1.0402	x	54.19765	18.235	0.077583	0.14%	988.29409	47.13718	17.31905	816.3712
13	1.0198	x	49.35353	18.411	0.068915	0.14%	908.64783	42.30275	17.48621	739.7148
14	1.0361	x	42.36529	18.54	0.060324	0.14%	785.45255	35.3285	17.60873	622.0899
15	1.0303	x	34.72765	18.639	0.051542	0.15%	647.28861	27.70612	17.70276	490.4748
16	1.0248	x	14.95941	18.796	0.012485	0.08%	281.1771	7.977425	17.85187	142.412
17	1.0291	x	-0.53495	18.89	0.018409	-3.44%	-10.105261	-7.48595	17.94115	-134.307
x	17.4701	x	Vave	Suml	Vstdev	Vstdv%	power	V corr	Icorrr	Pcorr
line item	output at	x								
x	58.9	x								
x	volts	x								

Panel 360-1 Post Thermal Vacuum

CURRENT-VOLTAGE

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	68.33	0	67.89	0	68.41	0.001	68.06	0	68.18	0	68.29	0	67.91	0.001	68.31	0.001	68.32	0
2	65.51	0.5048	65.44	0.4503	65.4	0.579	65.45	0.4833	65.51	0.5111	65.4	0.5499	65.35	0.4777	65.33	0.5725	65.4	0.5764
3	63.62	0.7059	63.54	0.6648	63.51	0.7868	63.56	0.6901	63.62	0.7138	63.5	0.7587	63.47	0.693	63.44	0.7794	63.51	0.7799
4	60.79	0.8771	60.29	0.8656	60.75	0.9446	60.54	0.8785	60.52	0.8899	60.67	0.9249	60.36	0.8858	60.75	0.9385	60.67	0.9343
5	60.01	0.9123	59.95	0.8835	59.91	0.9652	59.92	0.9034	59.99	0.91	59.89	0.9514	59.85	0.9068	59.83	0.9685	59.88	0.9576
6	59.41	0.9312	58.94	0.9154	59.38	0.9834	59.17	0.9291	59.15	0.9323	59.31	0.9681	59	0.9343	59.4	0.9794	59.31	0.9707
7	58.92	0.9451	58.9	0.9176	58.9	0.9918	58.9	0.9380	58.9	0.9395	58.9	0.9750	58.9	0.9367	58.9	0.9928	58.9	0.9790
8	58.9	0.9455	58.86	0.9198	58.8	0.9936	58.84	0.94	58.9	0.9395	58.8	0.9767	58.76	0.94	58.74	0.9971	58.8	0.981
9	58.03	0.9647	57.58	0.9467	58	1.007	57.79	0.9649	57.77	0.9634	57.93	0.9899	57.64	0.9695	58.01	1.007	57.92	0.9937
10	57.03	0.9868	56.96	0.9524	56.93	1.017	56.94	0.9858	57	0.9757	56.9	0.9995	56.87	0.9848	56.85	1.025	56.9	1.007
11	55.98	0.9975	55.52	0.9586	55.93	1.023	55.75	0.9964	55.74	0.9886	55.89	1.004	55.59	1.005	55.95	1.025	55.86	1.012
12	53.86	1.019	53.45	0.9767	53.85	1.032	53.67	1.013	53.66	0.9958	53.79	1.016	53.49	1.024	53.87	1.032	53.78	1.02
13	49.01	1.0390	48.63	1.0050	49.02	1.0410	48.83	1.0400	48.81	1.0080	48.94	1.0300	48.68	1.0420	48.99	1.0410	48.94	1.0280
14	42.11	1.059	41.78	1.028	42.09	1.054	41.96	1.068	41.96	1.022	42.05	1.04	41.82	1.065	42.1	1.055	42.04	1.038
15	34.52	1.076	34.26	1.046	34.51	1.063	34.39	1.082	34.38	1.032	34.46	1.053	34.29	1.078	34.51	1.069	34.46	1.046
16	14.98	1.101	14.96	1.091	14.97	1.09	14.95	1.103	14.96	1.06	14.93	1.073	14.94	1.099	14.92	1.086	14.95	1.066
17	-0.522	1.104	-0.3457	1.107	-0.4953	1.105	-0.4919	1.111	-0.5034	1.074	-0.3121	1.085	-0.5004	1.107	-0.4873	1.087	-0.5049	1.076
18	V	I	V	I	V	I	V	I	V	I	V	I	V	I	V	I	V	I
19	1&2	x	5&6	x	8&9	x	12&13	x	14&15	x	16&17	x	20&21	x	22&23	x	24&25	x

Panel 360-1 Post Thermal Vacuum

CURRENT-VOLTAGE

	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH
1	67.7	0.001	68.67	0.001	68.56	0.001	67.6	0.001	68.23	0	68.36	0	67.96	0	68.86	0
2	65.33	0.4371	65.51	0.6984	65.33	0.6704	65.39	0.3949	65.4	0.5168	65.45	0.5936	65.51	0.4527	65.4	0.7004
3	63.45	0.6557	63.61	0.8956	63.45	0.8713	63.52	0.6142	63.5	0.7255	63.56	0.7982	63.61	0.6692	63.51	0.8933
4	60.18	0.8722	60.99	1.016	60.89	1.005	60.06	0.8419	60.71	0.8946	60.64	0.9576	60.37	0.8711	61.25	1.01
5	59.83	0.8883	60	1.043	59.84	1.031	59.9	0.8488	59.91	0.9244	59.93	0.979	60.01	0.8827	59.91	1.044
6	58.9	0.9215	59.61	1.05	59.51	1.04	58.9	0.8890	59.32	0.9416	59.29	0.9985	59	0.9119	59.86	1.046
7	58.82	0.9244	58.92	1.064	58.9	1.0472	58.81	0.8926	58.9	0.9508	58.9	1.0059	58.9	0.9166	58.9	1.0626
8	58.75	0.9264	58.9	1.0642	58.75	1.049	58.72	0.8946	58.82	0.9525	58.84	1.007	58.9	0.9166	58.82	1.064
9	57.44	0.9643	58.23	1.072	58.13	1.062	57.36	0.9343	57.97	0.9697	57.9	1.022	57.64	0.9385	58.47	1.069
10	56.85	0.9748	57.02	1.084	56.85	1.073	56.91	0.9447	56.92	0.9835	56.94	1.031	57.02	0.9442	56.93	1.084
11	55.4	0.9972	56.13	1.088	56.04	1.078	55.28	0.9717	55.89	0.9921	55.84	1.043	55.58	0.9525	56.39	1.086
12	53.34	1.007	54.05	1.092	53.96	1.085	53.25	0.9913	53.81	1.002	53.75	1.048	53.51	0.964	54.28	1.094
13	48.55	1.0280	49.23	1.1030	49.16	1.0950	48.46	1.0100	48.96	1.0270	48.91	1.0580	48.68	0.9768	49.42	1.1010
14	41.72	1.057	42.24	1.108	42.17	1.1	41.64	1.028	42.04	1.037	42.02	1.067	41.82	0.9943	42.43	1.108
15	34.19	1.079	34.66	1.11	34.59	1.103	34.13	1.045	34.47	1.047	34.45	1.08	34.29	1.01	34.77	1.11
16	14.93	1.105	14.97	1.117	14.93	1.106	14.95	1.082	14.96	1.084	14.95	1.092	14.98	1.043	14.97	1.12
17	-0.4954	1.114	-0.4985	1.12	-0.4973	1.114	-0.5098	1.1	-0.4761	1.091	-0.404	1.103	-0.5002	1.077	-0.5097	1.122
18	V	I	V	I	V	I	V	I	V	I	V	I	V	I	V	I
19	26&27	x	30&31	x	33&34	x	18&19	x	3&4	x	10&11	x	7&29	x	26&32	x

Panel 340-1 Post Thermal Vacuum

CURRENT-VOLTAGE

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	68.86	0	68.69	0.001	68.76	0.001	68.7	0.001	68.83	0.001	68.82	0	68.71	0.001	68.8	0.001	68.76	0
2	65.46	0.6339	65.46	0.6894	65.34	0.6727	65.51	0.6236	65.45	0.6214	65.52	0.6569	65.43	0.6559	65.46	0.6558	65.47	0.634
3	63.56	0.8217	63.57	0.884	63.46	0.8705	63.62	0.8161	63.56	0.8129	63.63	0.8502	63.53	0.8477	63.57	0.8411	63.58	0.8264
4	61.27	0.9478	61.12	1.005	61.14	0.9956	61.05	0.9503	61.21	0.9436	61.2	0.9777	61.08	0.9801	61.19	0.973	61.13	0.9625
5	59.94	0.9961	59.96	1.039	59.83	1.031	60.01	0.9879	59.95	0.9754	60	1.011	59.91	1.015	59.94	1.013	59.950	0.9957
6	59.86	0.9957	59.71	1.042	59.76	1.033	59.67	0.996	59.82	0.9843	59.81	1.018	59.7	1.021	59.82	1.017	59.75	1.003
7	58.9	1.017	58.9	1.055	58.9	1.050	58.93	1.014	58.9	1.001	58.91	1.036	58.9	1.038	58.9	1.037	58.9	1.018
8	58.85	1.018	58.85	1.056	58.75	1.053	58.9	1.015	58.86	1.002	58.9	1.036	58.82	1.04	58.86	1.038	58.87	1.019
9	58.5	1.025	58.33	1.059	58.38	1.059	58.29	1.03	58.43	1.013	58.42	1.042	58.31	1.047	58.43	1.046	58.35	1.031
10	56.96	1.05	56.98	1.071	56.87	1.078	57.04	1.043	56.98	1.027	57.02	1.056	56.93	1.062	56.96	1.064	56.96	1.047
11	56.43	1.05	56.25	1.077	56.3	1.079	56.21	1.055	56.38	1.033	56.33	1.064	56.25	1.069	56.34	1.071	56.28	1.057
12	54.31	1.066	54.17	1.09	54.18	1.092	54.12	1.068	54.26	1.043	54.24	1.073	54.14	1.08	54.24	1.08	54.18	1.068
13	49.45	1.08	49.33	1.112	49.36	1.097	49.28	1.082	49.4	1.054	49.38	1.081	49.32	1.088	49.39	1.096	49.33	1.076
14	42.45	1.087	42.35	1.119	42.35	1.106	42.29	1.089	42.41	1.068	42.39	1.088	42.33	1.09	42.4	1.1	42.35	1.084
15	34.79	1.097	34.71	1.124	34.74	1.111	34.67	1.097	34.77	1.071	34.76	1.092	34.7	1.097	34.77	1.104	34.72	1.09
16	14.95	1.112	14.97	1.13	14.93	1.12	14.97	1.107	14.97	1.084	14.96	1.102	14.96	1.104	14.95	1.112	14.96	1.095
17	-0.5729	1.117	-0.5479	1.132	-0.5309	1.124	-0.5429	1.113	-0.5684	1.09	-0.5407	1.108	-0.5223	1.11	-0.5037	1.117	-0.5469	1.101
18	1&2	x	5&6	x	7&8	x	10&11	x	12&13	x	14&15	x	16&17	x	18&19	x	22&23	x
19	V	I	V	I	V	I	V	I	V	I	V	I	V	I	V	I	V	I

Panel 340-1 Post Thermal Vacuum

CURRENT-VOLTAGE

	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH
1	68.73	0.0021	68.56	0	68.97	0.0011	68.78	0.0021	68.77	0.0011	68.77	0	68.78	0	68.76	0
2	65.45	0.6562	65.45	0.5909	65.46	0.6843	65.42	0.6444	65.32	0.6518	65.53	0.6413	65.51	0.6436	65.45	0.6444
3	63.55	0.8545	63.58	0.7828	63.57	0.8688	63.53	0.8366	63.44	0.8461	63.64	0.8383	63.61	0.8362	63.55	0.8366
4	61.16	0.9755	60.92	0.9327	61.25	0.9897	61.18	0.9678	61.06	0.9808	61.07	0.9761	61.21	0.9663	61.16	0.973
5	59.95	1.009	59.95	0.9649	59.93	1.022	59.91	1.001	59.85	1.016	60.01	1.007	60.01	1	59.95	1.007
6	59.78	1.013	59.55	0.9787	59.87	1.024	59.8	1.006	59.69	1.02	59.68	1.014	59.83	1.006	59.78	1.01
7	58.9	1.028	58.9	0.993	58.9	1.040	58.9	1.020	58.9	1.036	58.92	1.03	58.93	1.024	58.9	1.029
8	58.86	1.029	58.86	0.9943	58.85	1.041	58.82	1.021	58.76	1.039	58.9	1.030	58.9	1.025	58.86	1.03
9	58.4	1.038	58.15	1.009	58.47	1.048	58.42	1.034	58.29	1.049	58.31	1.039	58.45	1.036	58.39	1.035
10	56.97	1.052	56.97	1.032	56.95	1.063	56.93	1.047	56.88	1.069	57.03	1.057	57.03	1.052	56.97	1.05
11	56.3	1.06	56.08	1.041	56.39	1.068	56.36	1.057	56.21	1.072	56.23	1.061	56.35	1.06	56.33	1.06
12	54.21	1.072	54	1.059	54.3	1.079	54.24	1.067	54.12	1.084	54.15	1.074	54.26	1.072	54.24	1.068
13	49.37	1.077	49.17	1.072	49.45	1.088	49.38	1.074	49.3	1.095	49.3	1.081	49.42	1.086	49.38	1.072
14	42.39	1.084	42.22	1.083	42.45	1.095	42.41	1.08	42.31	1.103	42.31	1.089	42.41	1.095	42.39	1.08
15	34.72	1.087	34.59	1.094	34.79	1.102	34.75	1.087	34.69	1.109	34.68	1.093	34.77	1.1	34.75	1.084
16	14.96	1.096	14.96	1.107	14.95	1.112	14.97	1.091	14.94	1.119	14.97	1.101	14.98	1.109	14.96	1.095
17	-0.5425	1.098	-0.5309	1.115	-0.5391	1.118	-0.5197	1.101	-0.527	1.121	-0.5295	1.105	-0.5096	1.118	-0.5193	1.102
18	24&25	x	28&29	x	30&31	x	33&34	x	3&4	x	26&27	x	9&21	x	20&32	x
19	V	I	V	I	V	I	V	I	V	I	V	I	V	I	V	I

Panel 360-1 Post Thermal Vacuum

POWER

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	68.33	0.000	67.89	0.000	68.41	0.068	68.06	0.000	68.18	0.000	68.29	0.000	67.91	0.068	68.31	0.068
2	65.51	33.069	65.44	29.468	65.4	37.867	65.45	31.632	65.51	33.482	65.4	35.963	65.35	31.218	65.33	37.401
3	63.62	44.909	63.54	42.241	63.51	49.970	63.56	43.863	63.62	45.412	63.5	48.177	63.47	43.985	63.44	49.445
4	60.79	53.319	60.29	52.187	60.75	57.384	60.54	53.184	60.52	53.857	60.67	56.114	60.36	53.467	60.75	57.014
5	60.01	54.747	59.95	52.966	59.91	57.825	59.92	54.132	59.99	54.591	59.89	56.979	59.85	54.272	59.83	57.945
6	59.41	55.323	58.94	53.954	59.38	58.394	59.17	54.975	59.15	55.146	59.31	57.418	59	55.124	59.4	58.176
7	58.92	55.685	58.9	54.047	58.9	58.419	58.9	55.249	58.9	55.337	58.9	57.428	58.9	55.170	58.9	58.476
8	58.9	55.692	58.86	54.139	58.8	58.424	58.84	55.310	58.9	55.337	58.8	57.430	58.76	55.234	58.74	58.570
9	58.03	55.982	57.58	54.511	58	58.406	57.79	55.762	57.77	55.656	57.93	57.345	57.64	55.882	58.01	58.416
10	57.03	56.277	56.96	54.249	56.93	57.898	56.94	56.131	57	55.615	56.9	56.872	56.87	56.006	56.85	58.271
11	55.98	55.840	55.52	53.221	55.93	57.216	55.75	55.549	55.74	55.105	55.89	56.114	55.59	55.868	55.95	57.349
12	53.86	54.883	53.45	52.205	53.85	55.573	53.67	54.368	53.66	53.435	53.79	54.651	53.49	54.774	53.87	55.594
13	49.01	50.921	48.63	48.873	49.02	51.030	48.83	50.783	48.81	49.200	48.94	50.408	48.68	50.725	48.99	50.999
14	42.11	44.594	41.78	42.950	42.09	44.363	41.96	44.813	41.96	42.883	42.05	43.732	41.82	44.538	42.1	44.416
15	34.52	37.144	34.26	35.836	34.51	36.684	34.39	37.210	34.38	35.480	34.46	36.286	34.29	36.965	34.51	36.891
16	14.98	16.493	14.96	16.321	14.97	16.317	14.95	16.490	14.96	15.858	14.93	16.020	14.94	16.419	14.92	16.203
17	-0.522	-0.576	-0.3457	-0.383	-0.4953	-0.547	-0.4919	-0.547	-0.5034	-0.541	-0.3121	-0.339	-0.5004	-0.554	-0.4873	-0.530
18	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P
19	1&2	x	5&6	x	8&9	x	12&13	x	14&15	x	16&17	x	20&21	x	22&23	x

Panel 360-1 Post Thermal Vacuum

POWER

	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH
1	68.32	0.000	67.7	0.068	68.67	0.069	68.56	0.069	67.6	0.068	68.23	0.000	68.36	0.000	67.96	0.000	68.86	0.000
2	65.4	37.697	65.33	28.556	65.51	45.752	65.33	43.797	65.39	25.823	65.4	33.799	65.45	38.851	65.51	29.656	65.4	45.806
3	63.51	49.531	63.45	41.604	63.61	56.969	63.45	55.284	63.52	39.014	63.5	46.069	63.56	50.734	63.61	42.568	63.51	56.733
4	60.67	56.684	60.18	52.489	60.99	61.966	60.89	61.194	60.06	50.565	60.71	54.311	60.64	58.069	60.37	52.588	61.25	61.863
5	59.88	57.341	59.83	53.147	60	62.580	59.84	61.695	59.9	50.843	59.91	55.381	59.93	58.671	60.01	52.971	59.91	62.546
6	59.31	57.572	58.9	54.279	59.61	62.591	59.51	61.890	58.9	52.361	59.32	55.856	59.29	59.201	59	53.802	59.86	62.614
7	58.9	57.662	58.82	54.373	58.92	62.691	58.9	61.681	58.81	52.494	58.9	56.000	58.9	59.246	58.9	53.988	58.9	62.588
8	58.8	57.683	58.75	54.426	58.9	62.683	58.75	61.629	58.72	52.531	58.82	56.026	58.84	59.252	58.9	53.988	58.82	62.584
9	57.92	57.555	57.44	55.389	58.23	62.423	58.13	61.734	57.36	53.591	57.97	56.214	57.9	59.174	57.64	54.095	58.47	62.504
10	56.9	57.298	56.85	55.417	57.02	61.810	56.85	61.000	56.91	53.763	56.92	55.981	56.94	58.705	57.02	53.838	56.93	61.712
11	55.86	56.530	55.4	55.245	56.13	61.069	56.04	60.411	55.28	53.716	55.89	55.448	55.84	58.241	55.58	52.940	56.39	61.240
12	53.78	54.856	53.34	53.713	54.05	59.023	53.96	58.547	53.25	52.787	53.81	53.918	53.75	56.330	53.51	51.584	54.28	59.382
13	48.94	50.310	48.55	49.909	49.23	54.301	49.16	53.830	48.46	48.945	48.96	50.282	48.91	51.747	48.68	47.551	49.42	54.411
14	42.04	43.638	41.72	44.098	42.24	46.802	42.17	46.387	41.64	42.806	42.04	43.595	42.02	44.835	41.82	41.582	42.43	47.012
15	34.46	36.045	34.19	36.891	34.66	38.473	34.59	38.153	34.13	35.666	34.47	36.090	34.45	37.206	34.29	34.633	34.77	38.595
16	14.95	15.937	14.93	16.498	14.97	16.721	14.93	16.513	14.95	16.176	14.96	16.217	14.95	16.325	14.98	15.624	14.97	16.766
17	-0.5049	-0.543	-0.4954	-0.552	-0.4985	-0.558	-0.4973	-0.554	-0.5098	-0.561	-0.4761	-0.519	-0.404	-0.446	-0.5002	-0.539	-0.5097	-0.572
18	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P
19	24&25	x	26&27	x	30&31	x	33&34	x	18&19	x	3&4	x	10&11	x	7&29	x	26&32	x

Panel 340-1 Post Thermal Vacuum

POWER

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	68.86	0.000	68.69	0.069	68.76	0.069	68.7	0.069	68.83	0.069	68.82	0.000	68.71	0.069	68.8	0.069	68.76	0.000
2	65.46	41.495	65.46	45.128	65.34	43.954	65.51	40.852	65.45	40.671	65.52	43.040	65.43	42.916	65.46	42.929	65.47	41.508
3	63.56	52.227	63.57	56.196	63.46	55.242	63.62	51.920	63.56	51.668	63.63	54.098	63.53	53.854	63.57	53.469	63.58	52.543
4	61.27	58.072	61.12	61.426	61.14	60.871	61.05	58.016	61.21	57.758	61.2	59.835	61.08	59.865	61.19	59.538	61.13	58.838
5	59.94	59.706	59.96	62.298	59.83	61.685	60.01	59.284	59.95	58.475	60	60.660	59.91	60.809	59.94	60.719	59.95	59.692
6	59.86	59.603	59.71	62.218	59.76	61.732	59.67	59.431	59.82	58.881	59.81	60.887	59.7	60.954	59.82	60.837	59.75	59.929
7	58.9	59.895	58.9	62.150	58.9	61.847	58.93	59.755	58.9	58.974	58.91	61.031	58.9	61.154	58.9	61.087	58.9	59.987
8	58.85	59.909	58.85	62.146	58.75	61.864	58.9	59.769	58.86	58.978	58.9	61.028	58.82	61.173	58.86	61.097	58.87	59.989
9	58.5	59.963	58.33	61.771	58.38	61.824	58.29	60.039	58.43	59.190	58.42	60.874	58.31	61.051	58.43	61.118	58.35	60.159
10	56.96	59.808	56.98	61.026	56.87	61.306	57.04	59.493	56.98	58.518	57.02	60.213	56.93	60.460	56.96	60.605	56.96	59.637
11	56.43	59.252	56.25	60.581	56.3	60.748	56.21	59.302	56.38	58.241	56.33	59.935	56.25	60.131	56.34	60.340	56.28	59.488
12	54.31	57.894	54.17	59.045	54.18	59.165	54.12	57.800	54.26	56.593	54.24	58.200	54.14	58.471	54.24	58.579	54.18	57.864
13	49.45	53.406	49.33	54.855	49.36	54.148	49.28	53.321	49.4	52.068	49.38	53.380	49.32	53.660	49.39	54.131	49.33	53.079
14	42.45	46.143	42.35	47.390	42.35	46.839	42.29	46.054	42.41	45.294	42.39	46.120	42.33	46.140	42.4	46.640	42.35	45.907
15	34.79	38.165	34.71	39.014	34.74	38.596	34.67	38.033	34.77	37.239	34.76	37.958	34.7	38.066	34.77	38.386	34.72	37.845
16	14.95	16.624	14.97	16.916	14.93	16.722	14.97	16.572	14.97	16.227	14.96	16.486	14.96	16.516	14.95	16.624	14.96	16.381
17	-0.5729	-0.640	-0.5479	-0.620	-0.5309	-0.597	-0.5429	-0.604	-0.5684	-0.620	-0.5407	-0.599	-0.5223	-0.580	-0.5037	-0.563	-0.5469	-0.602
18	1&2	x	5&6	x	7&8	x	10&11	x	12&13	x	14&15	x	16&17	x	18&19	x	22&23	x
19	V	I	V	I	V	I	V	I	V	I	V	I	V	I	V	I	V	I

Panel 340-1 Post Thermal Vacuum

POWER

	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH
1	68.73	0.144	68.56	0.000	68.97	0.076	68.78	0.144	68.77	0.076	68.77	0.000	68.78	0.000	68.76	0.000
2	65.45	42.948	65.45	38.674	65.46	44.794	65.42	42.157	65.32	42.576	65.53	42.024	65.51	42.162	65.45	42.176
3	63.55	54.303	63.58	49.770	63.57	55.230	63.53	53.149	63.44	53.677	63.64	53.349	63.61	53.191	63.55	53.166
4	61.16	59.662	60.92	56.820	61.25	60.619	61.18	59.210	61.06	59.888	61.07	59.610	61.21	59.147	61.16	59.509
5	59.95	60.490	59.95	57.846	59.93	61.248	59.91	59.970	59.85	60.808	60.01	60.430	60.01	60.010	59.95	60.370
6	59.78	60.557	59.55	58.282	59.87	61.307	59.8	60.159	59.69	60.884	59.68	60.516	59.83	60.189	59.78	60.378
7	58.9	60.567	58.9	58.511	58.9	61.266	58.9	60.065	58.9	61.029	58.92	60.688	58.93	60.344	58.9	60.616
8	58.86	60.567	58.86	58.524	58.85	61.263	58.82	60.055	58.76	61.052	58.9	60.684	58.9	60.358	58.86	60.626
9	58.4	60.619	58.15	58.673	58.47	61.277	58.42	60.406	58.29	61.146	58.31	60.584	58.45	60.554	58.39	60.434
10	56.97	59.932	56.97	58.793	56.95	60.538	56.93	59.606	56.88	60.805	57.03	60.281	57.03	59.996	56.97	59.819
11	56.3	59.678	56.08	58.379	56.39	60.225	56.36	59.573	56.21	60.257	56.23	59.660	56.35	59.731	56.33	59.710
12	54.21	58.113	54	57.186	54.3	58.590	54.24	57.874	54.12	58.666	54.15	58.157	54.26	58.167	54.24	57.928
13	49.37	53.171	49.17	52.710	49.45	53.802	49.38	53.034	49.3	53.984	49.3	53.293	49.42	53.670	49.38	52.935
14	42.39	45.951	42.22	45.724	42.45	46.483	42.41	45.803	42.31	46.668	42.31	46.076	42.41	46.439	42.39	45.781
15	34.72	37.741	34.59	37.841	34.79	38.339	34.75	37.773	34.69	38.471	34.68	37.905	34.77	38.247	34.75	37.669
16	14.96	16.396	14.96	16.561	14.95	16.624	14.97	16.332	14.94	16.718	14.97	16.482	14.98	16.613	14.96	16.381
17	-0.5425	-0.596	-0.5309	-0.592	-0.5391	-0.603	-0.5197	-0.572	-0.527	-0.591	-0.5295	-0.585	-0.5096	-0.570	-0.5193	-0.572
18	24&25	x	28&29	x	30&31	x	33&34	x	3&4	x	26&27	x	9&21	x	20&32	x
19	V	I	V	I	V	I	V	I	V	I	V	I	V	I	V	I

828340-2 A T/V Power

68.02	0.000	68.18	0.068	68.8	0.000	68.37	-0.068	67.8	0.142	68.21	0.000	68.66	0.069	68.71	0.144	68.76	0.000	68.45	0.068
65.49	31.553	65.42	33.057	65.42	42.255	65.43	35.502	65.51	27.567	65.43	34.161	65.49	41.219	65.38	41.000	65.37	40.601	65.55	37.967
63.58	44.932	63.54	45.361	63.54	52.643	63.55	47.745	63.63	40.621	63.54	46.003	63.59	53.028	63.48	52.555	63.47	51.271	63.66	49.782
60.68	54.151	60.7	53.361	61.42	57.563	61.01	55.348	60.38	50.598	60.81	53.178	61.23	59.069	61.27	58.580	61.27	56.803	61.03	56.544
59.97	54.963	59.91	54.165	59.98	58.966	59.93	56.616	59.98	51.193	59.91	54.344	59.99	60.110	59.9	59.714	59.89	57.974	60.04	57.260
59.32	55.571	59.35	54.697	59.94	59.017	59.65	56.864	59.02	52.132	59.42	54.643	59.82	60.179	59.86	59.579	59.89	58.015	59.66	57.154
58.9	55.733	58.9	54.852	58.9	59.252	58.9	57.135	58.9	52.092	58.9	54.905	58.9	60.280	58.9	59.853	58.9	58.264	58.94	57.042
58.87	55.744	58.82	54.879	58.85	59.262	58.83	57.159	58.88	52.085	58.82	54.944	58.87	60.283	58.77	59.887	58.77	58.294	58.9	57.041
57.93	55.798	57.96	55.097	58.59	59.176	58.27	57.344	57.66	52.644	58.04	54.958	58.45	60.320	58.51	59.914	58.51	58.305	58.27	57.011
56.97	55.352	56.94	54.953	56.96	58.897	56.94	57.054	57	52.611	56.94	54.839	57	59.679	56.89	59.222	56.91	57.877	57.05	56.731
55.86	54.927	55.89	54.672	56.51	58.431	56.22	56.501	55.6	52.047	55.99	54.445	56.38	59.312	56.42	58.959	56.41	57.707	56.21	56.491
53.78	53.436	53.82	53.206	54.4	56.848	54.1	54.912	53.51	50.626	53.9	52.849	54.29	57.493	54.3	57.232	54.3	56.146	54.12	55.257
48.92	49.507	49.01	49.108	49.55	52.374	49.26	50.738	48.69	46.772	49.08	48.682	49.41	52.770	49.47	52.587	49.45	51.873	49.27	51.241
42.04	43.091	42.07	42.743	42.53	45.422	42.27	44.003	41.83	40.793	42.12	42.204	42.41	45.548	42.45	45.422	42.45	44.870	42.32	44.521
34.47	35.745	34.48	35.411	34.87	37.590	34.66	36.497	34.3	33.786	34.53	35.013	34.76	37.541	34.79	37.469	34.8	36.992	34.67	36.750
14.95	15.757	14.94	15.553	14.97	16.332	14.95	16.071	14.97	15.150	14.94	15.448	14.98	16.298	14.95	16.236	14.96	16.037	14.97	15.988
-0.8113	-0.863	-0.8036	-0.847	-0.8084	-0.887	-0.8062	-0.874	-0.8084	-0.833	-0.7942	-0.828	-0.8128	-0.889	-0.821	-0.897	-0.8117	-0.873	-0.8	-0.860
1&2	x	5&6	x	7&8	x	10&11	x	12&13	x	14&15	x	16&17	x	18&19	x	22&23	x	24&25	x
V	I	V	I	V	I	V	I	V	I	V	I	V	I	V	I	V	I	V	I
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

((IVP 828340-2 POST 1.1V POWER

68.72	0.000	68.54	0.000	68.5	-0.069	68.56	-0.069	67.9	0.068	68.27	-0.068	68.21	0.000		1	55.7328
65.49	41.350	65.44	37.366	65.44	39.833	65.5	40.191	65.47	30.529	65.42	33.004	65.5	35.416		2	54.8523
63.58	52.447	63.55	48.730	63.55	51.641	63.59	51.591	63.57	43.387	63.53	45.310	63.6	47.732		3	59.2518
61.23	58.162	61.02	55.290	61.08	57.983	61.08	57.831	60.46	52.794	60.83	53.670	60.89	55.105		4	57.1352
59.97	59.034	59.93	56.418	59.93	59.073	59.97	59.034	59.97	53.757	59.93	54.776	59.98	56.501		5	52.0920
59.84	59.194	59.64	56.598	59.7	59.037	59.7	59.055	59.09	54.333	59.48	55.305	59.51	56.612		6	54.9046
58.9	59.223	58.9	56.918	58.9	59.281	58.9	59.344	58.9	54.713	58.9	55.454	58.9	57.121		7	60.2801
58.87	59.223	58.83	56.947	58.83	59.301	58.88	59.351	58.88	54.753	58.84	55.468	58.88	57.137		8	59.8526
58.47	59.113	58.25	56.974	58.32	59.195	58.33	59.205	57.73	55.138	58.09	55.813	58.12	57.132		9	58.2643
56.97	58.907	56.95	56.739	56.96	58.783	56.98	58.860	56.99	55.155	56.96	55.627	56.98	57.094		10	57.0407
56.39	58.533	56.2	56.425	56.23	58.142	56.26	58.454	55.66	54.614	56.02	55.421	56.07	56.462		11	59.2228
54.28	56.885	54.08	55.216	54.15	56.533	54.15	56.803	53.58	53.526	53.93	53.741	53.98	54.844		12	56.9185
49.41	52.424	49.25	50.974	49.3	51.814	49.31	52.071	48.76	49.443	49.09	49.286	49.14	50.712		13	59.2807
42.43	45.315	42.29	44.193	42.32	44.859	42.32	45.198	41.88	43.053	42.15	42.909	42.19	44.089		14	59.3442
34.77	37.308	34.65	36.417	34.71	36.966	34.7	37.372	34.34	35.714	34.56	35.631	34.56	36.599		15	54.7128
14.95	16.176	14.95	15.896	14.96	16.097	14.96	16.291	14.96	15.977	14.96	15.828	14.96	16.112		16	55.4538
-0.8138	-0.885	-0.8011	-0.856	-0.8009	-0.867	-0.8017	-0.880	-0.7925	-0.857	-0.8074	-0.871	-0.7969	-0.866		17	57.1208
28&29	x	30&31	x	33&34	x	3&4	x	26&27	x	9&21	x	20&32	x		x	971.4600
V	I	V	I	V	I	V	I	V	I	V	I	V	I		line item	output at
x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	58.9
x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	volts

828350-1 1251 - T/V POWER

68.34	0.068	68.5	0.000	68.34	0.000	68.6	-0.069	68.57	0.069	68.57	0.144	68.35	0.075	68.63	0.075	68.6	0.069	68.79	0.000
65.53	35.242	65.56	39.592	65.38	37.214	65.49	43.629	65.43	39.572	65.49	39.805	65.49	39.942	65.42	39.344	65.48	42.058	65.49	44.697
63.63	47.245	63.66	51.361	63.48	49.705	63.59	54.808	63.54	50.946	63.59	51.266	63.59	52.195	63.54	50.819	63.58	53.388	63.59	55.559
60.82	55.091	61.14	57.948	60.95	57.232	61.09	60.265	61.14	57.251	61.06	57.824	60.94	59.063	61.19	57.096	61.15	59.022	61.32	60.713
60.03	56.116	60.03	59.304	59.86	58.154	59.97	61.049	59.92	58.368	59.97	58.873	59.97	60.030	59.91	58.227	59.99	59.924	59.96	61.519
59.43	56.548	59.76	59.419	59.56	58.506	59.71	61.083	59.76	58.415	59.68	58.970	59.55	60.086	59.8	58.287	59.77	59.890	59.94	61.379
58.94	57.024	58.94	59.883	58.9	58.778	58.9	61.107	58.9	58.749	58.9	59.158	58.9	60.162	58.9	58.589	58.9	60.008	58.9	61.459
58.9	57.028	58.9	59.880	58.77	58.829	58.87	61.107	58.82	58.779	58.87	59.164	58.87	60.165	58.82	58.614	58.89	60.009	58.87	61.460
58.06	57.079	58.38	59.840	58.18	58.936	58.35	60.976	58.39	58.799	58.3	59.291	58.19	60.227	58.42	58.595	58.39	59.967	58.56	61.312
57.04	57.154	57.05	59.503	56.89	58.597	56.97	60.274	56.94	58.591	56.97	58.793	56.98	59.772	56.94	58.136	56.99	59.384	56.98	60.741
56	56.504	56.28	59.038	56.1	57.895	56.25	59.963	56.29	58.316	56.24	58.490	56.11	59.308	56.34	57.636	56.3	59.002	56.46	60.243
53.92	55.376	54.2	57.127	54.02	56.127	54.17	58.124	54.2	57.073	54.15	56.749	54.02	57.693	54.23	56.020	54.21	57.137	54.35	58.589
49.09	51.201	49.34	52.942	49.2	51.955	49.32	53.512	49.34	52.646	49.32	52.476	49.2	52.988	49.39	51.563	49.36	52.618	49.49	53.845
42.15	44.384	42.34	45.981	42.23	45.102	42.34	46.362	42.36	45.452	42.32	45.452	42.24	45.704	42.39	44.721	42.38	45.516	42.48	46.431
34.54	36.647	34.71	37.869	34.6	37.333	34.7	38.101	34.72	37.428	34.69	37.604	34.61	37.656	34.74	36.998	34.74	37.519	34.83	38.278
14.98	16.118	14.98	16.538	14.95	16.415	14.96	16.621	14.95	16.266	14.96	16.381	14.95	16.370	14.95	16.236	14.98	16.253	14.96	16.546
-0.7877	-0.859	-0.7723	-0.858	-0.7702	-0.850	-0.7612	-0.849	-0.7882	-0.860	-0.7807	-0.860	-0.7652	-0.846	-0.799	-0.877	-0.7812	-0.853	-0.7912	-0.875
1&2	x	5&6	x	7&8	x	10&11	x	12&13	x	14&15	x	16&17	x	18&19	x	22&23	x	24&25	x
V	I	V	I	V	I	V	I	V	I	V	I	V	I	V	I	V	I	V	I
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

828350-1 R - T/V
power

66.03	0.000	68.46	0.000	68.82	0.145	68.57	0.144	68.5	0.075	68.74	0.000	68.59	0.000	x	1	57.0275
65.38	12.331	65.49	44.690	65.43	44.224	65.48	42.280	65.55	43.211	65.49	43.407	65.38	42.222	x	2	59.8803
63.48	37.847	63.59	56.684	63.55	55.034	63.58	54.342	63.65	54.720	63.59	54.389	63.48	53.196	x	3	58.7777
59.88	57.976	61.04	62.383	61.35	60.056	61.01	60.620	61.06	60.370	61.16	59.527	61.09	58.671	x	4	61.1066
58.9	59.600	59.97	62.849	59.97	60.810	59.98	61.420	60.03	61.531	59.97	60.510	59.87	59.631	x	5	58.7495
58.83	59.712	59.66	63.061	59.92	60.459	59.62	61.647	59.68	61.351	59.78	60.318	59.7	59.700	x	6	59.1576
58.78	59.779	58.9	63.051	58.9	60.477	58.9	61.658	58.93	61.759	58.9	60.236	58.9	59.913	x	7	60.1620
57.49	60.537	58.87	63.050	58.83	60.477	58.89	61.658	58.9	61.739	58.88	60.234	58.77	59.945	x	8	58.5890
56.89	60.417	58.29	62.895	58.58	60.747	58.24	61.501	58.31	61.342	58.41	59.753	58.33	59.905	x	9	60.0077
56.16	60.372	56.97	61.983	56.94	59.673	56.99	60.694	57.03	61.022	56.97	59.192	56.89	59.450	x	10	61.4586
54.15	59.078	56.21	61.550	56.49	59.710	56.18	60.225	56.23	60.447	56.34	58.594	56.27	58.971	x	11	59.5997
52.16	57.428	54.11	59.629	54.39	58.143	54.08	58.460	54.14	58.796	54.22	57.473	54.16	57.193	x	12	63.0506
47.45	52.480	49.29	54.613	49.51	53.421	49.25	53.830	49.31	53.994	49.39	53.440	49.31	52.811	x	13	60.4773
40.77	45.295	42.28	47.227	42.52	46.092	42.27	46.624	42.3	46.488	42.37	46.099	42.34	45.727	x	14	61.6578
33.4	37.174	34.67	38.796	34.86	37.893	34.66	38.299	34.7	38.309	34.74	37.971	34.69	37.673	x	15	61.7386
14.96	16.725	14.95	16.729	14.94	16.270	14.97	16.692	14.96	16.636	14.96	16.486	14.94	16.359	x	16	60.2364
-0.7364	-0.827	-0.7668	-0.860	-0.8016	-0.880	-0.7807	-0.876	-0.7774	-0.868	-0.7905	-0.874	-0.7786	-0.854	x	17	59.9133
28&29	x	30&31	x	33&34	x	3&4	x	26&27	x	9&21	x	20&32	x	x	x	1021.5903
V	I	V	I	V	I	V	I	V	I	V	I	V	I	x	line item	output at
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	58.9
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	volts

828340-2 Post T'' I & V

68.02	0	68.18	0.001	68.8	0	68.37	-0.001	67.8	0.0021	68.21	0	68.66	0.001	68.71	0.0021	68.76	0	68.45	0.001
65.49	0.4818	65.42	0.5053	65.42	0.6459	65.43	0.5426	65.51	0.4208	65.43	0.5221	65.49	0.6294	65.38	0.6271	65.37	0.6211	65.55	0.5792
63.58	0.7067	63.54	0.7139	63.54	0.8285	63.55	0.7513	63.63	0.6384	63.54	0.724	63.59	0.8339	63.48	0.8279	63.47	0.8078	63.66	0.782
60.68	0.8924	60.7	0.8791	61.42	0.9372	61.01	0.9072	60.38	0.838	60.81	0.8745	61.23	0.9647	61.27	0.9561	61.27	0.9271	61.03	0.9265
59.97	0.9165	59.91	0.9041	59.98	0.9831	59.93	0.9447	59.98	0.8535	59.91	0.9071	59.99	1.002	59.9	0.9969	59.89	0.968	60.04	0.9537
59.32	0.9368	59.35	0.9216	59.94	0.9846	59.65	0.9533	59.02	0.8833	59.42	0.9196	59.82	1.006	59.86	0.9953	59.89	0.9687	59.66	0.958
58.9	0.946	58.9	0.931	58.9	1.006	58.9	0.970	58.9	0.884	58.9	0.932	58.9	1.023	58.9	1.016	58.9	0.989	58.94	0.9678
58.87	0.9469	58.82	0.933	58.85	1.007	58.83	0.9716	58.88	0.8846	58.82	0.9341	58.87	1.024	58.77	1.019	58.77	0.9919	58.9	0.968
57.93	0.9632	57.96	0.9506	58.59	1.01	58.27	0.9841	57.66	0.913	58.04	0.9469	58.45	1.032	58.51	1.024	58.51	0.9965	58.27	0.9784
56.97	0.9716	56.94	0.9651	56.96	1.034	56.94	1.002	57	0.923	56.94	0.9631	57	1.047	56.89	1.041	56.91	1.017	57.05	0.9944
55.86	0.9833	55.89	0.9782	56.51	1.034	56.22	1.005	55.6	0.9361	55.99	0.9724	56.38	1.052	56.42	1.045	56.41	1.023	56.21	1.005
53.78	0.9936	53.82	0.9886	54.4	1.045	54.1	1.015	53.51	0.9461	53.9	0.9805	54.29	1.059	54.3	1.054	54.3	1.034	54.12	1.021
48.92	1.012	49.01	1.002	49.55	1.057	49.26	1.03	48.69	0.9606	49.08	0.9919	49.41	1.068	49.47	1.063	49.45	1.049	49.27	1.04
42.04	1.025	42.07	1.016	42.53	1.068	42.27	1.041	41.83	0.9752	42.12	1.002	42.41	1.074	42.45	1.07	42.45	1.057	42.32	1.052
34.47	1.037	34.48	1.027	34.87	1.078	34.66	1.053	34.3	0.985	34.53	1.014	34.76	1.08	34.79	1.077	34.8	1.063	34.67	1.06
14.95	1.054	14.94	1.041	14.97	1.091	14.95	1.075	14.97	1.012	14.94	1.034	14.98	1.088	14.95	1.086	14.96	1.072	14.97	1.068
-0.8113	1.064	-0.8036	1.054	-0.8084	1.097	-0.8062	1.084	-0.8084	1.031	-0.7942	1.043	-0.8128	1.094	-0.821	1.093	-0.8117	1.076	-0.8	1.075
1&2	x	5&6	x	7&8	x	10&11	x	12&13	x	14&15	x	16&17	x	18&19	x	22&23	x	24&25	x
V	I	V	I	V	I	V	I	V	I	V	I	V	I	V	I	V	I	V	I
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

8293340-2 POS 1/4
I of 4

68.72	0	68.54	0	68.5	-0.001	68.56	-0.001	67.9	0.001	68.27	-0.001	68.21	0	x	1	0.9462
65.49	0.6314	65.44	0.571	65.44	0.6087	65.5	0.6136	65.47	0.4663	65.42	0.5045	65.5	0.5407	x	2	0.9313
63.58	0.8249	63.55	0.7668	63.55	0.8126	63.59	0.8113	63.57	0.6825	63.53	0.7132	63.6	0.7505	x	3	1.0060
61.23	0.9499	61.02	0.9061	61.08	0.9493	61.08	0.9468	60.46	0.8732	60.83	0.8823	60.89	0.905	x	4	0.9700
59.97	0.9844	59.93	0.9414	59.93	0.9857	59.97	0.9844	59.97	0.8964	59.93	0.914	59.98	0.942	x	5	0.8844
59.84	0.9892	59.64	0.949	59.7	0.9889	59.7	0.9892	59.09	0.9195	59.48	0.9298	59.51	0.9513	x	6	0.9322
58.9	1.005	58.9	0.966	58.9	1.006	58.9	1.008	58.9	0.9289	58.9	0.941	58.9	0.970	x	7	1.0234
58.87	1.006	58.83	0.968	58.83	1.008	58.88	1.008	58.88	0.9299	58.84	0.9427	58.88	0.9704	x	8	1.0162
58.47	1.011	58.25	0.9781	58.32	1.015	58.33	1.015	57.73	0.9551	58.09	0.9608	58.12	0.983	x	9	0.9892
56.97	1.034	56.95	0.9963	56.96	1.032	56.98	1.033	56.99	0.9678	56.96	0.9766	56.98	1.002	x	10	0.9684
56.39	1.038	56.2	1.004	56.23	1.034	56.26	1.039	55.66	0.9812	56.02	0.9893	56.07	1.007	x	11	1.0055
54.28	1.048	54.08	1.021	54.15	1.044	54.15	1.049	53.58	0.999	53.93	0.9965	53.98	1.016	x	12	0.9664
49.41	1.061	49.25	1.035	49.3	1.051	49.31	1.056	48.76	1.014	49.09	1.004	49.14	1.032	x	13	1.0065
42.43	1.068	42.29	1.045	42.32	1.06	42.32	1.068	41.88	1.028	42.15	1.018	42.19	1.045	x	14	1.0075
34.77	1.073	34.65	1.051	34.71	1.065	34.7	1.077	34.34	1.04	34.56	1.031	34.56	1.059	x	15	0.9289
14.95	1.082	14.95	1.0633	14.96	1.076	14.96	1.089	14.96	1.068	14.96	1.058	14.96	1.077	x	16	0.9415
-0.8138	1.088	-0.8011	1.068	-0.8009	1.083	-0.8017	1.098	-0.7925	1.081	-0.8074	1.079	-0.7969	1.087	x	17	0.9698
28&29	x	30&31	x	33&34	x	3&4	x	26&27	x	9&21	x	20&32	x	x	x	16.4934
V	I	V	I	V	I	V	I	V	I	V	I	V	I	x	line item	output at
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	58.9
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	volts

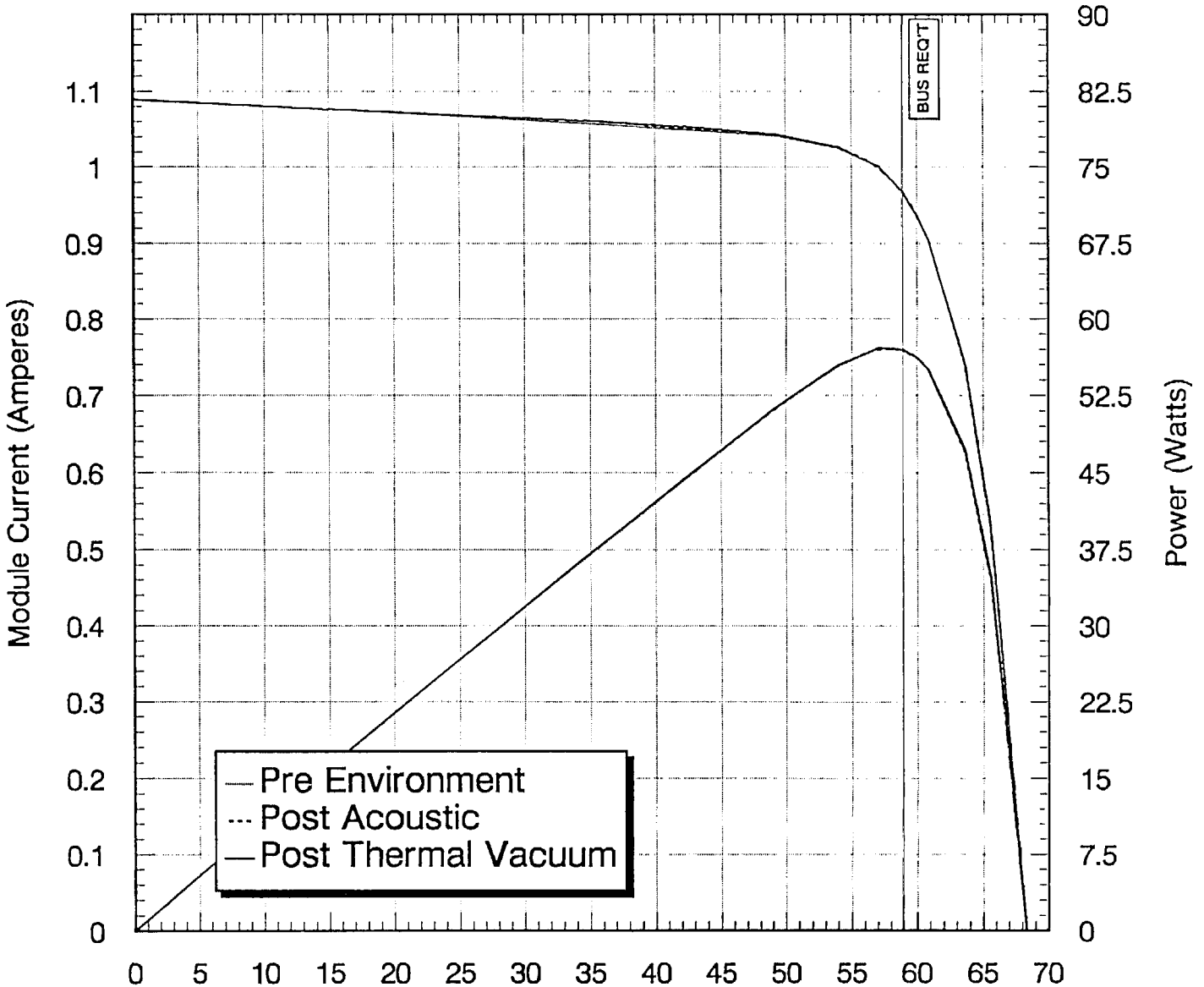
828350-1 T/V I&V

68.34	0.001	68.5	0	68.34	0	68.6	-0.001	68.57	0.001	68.57	0.0021	68.35	0.0011	68.63	0.0011	68.6	0.001	68.79	0
65.53	0.5378	65.56	0.6039	65.38	0.5692	65.49	0.6662	65.43	0.6048	65.49	0.6078	65.49	0.6099	65.42	0.6014	65.48	0.6423	65.49	0.6825
63.63	0.7425	63.66	0.8068	63.48	0.783	63.59	0.8619	63.54	0.8018	63.59	0.8062	63.59	0.8208	63.54	0.7998	63.58	0.8397	63.59	0.8737
60.82	0.9058	61.14	0.9478	60.95	0.939	61.09	0.9865	61.14	0.9364	61.06	0.947	60.94	0.9692	61.19	0.9331	61.15	0.9652	61.32	0.9901
60.03	0.9348	60.03	0.9879	59.86	0.9715	59.97	1.018	59.92	0.9741	59.97	0.9817	59.97	1.001	59.91	0.9719	59.99	0.9989	59.96	1.026
59.43	0.9515	59.76	0.9943	59.56	0.9823	59.71	1.023	59.76	0.9775	59.68	0.9881	59.55	1.009	59.8	0.9747	59.77	1.002	59.94	1.024
58.94	0.9675	58.94	1.016	58.9	0.998	58.9	1.037	58.9	0.997	58.9	1.004	58.9	1.021	58.9	0.995	58.9	1.019	58.9	1.043
58.9	0.968	58.9	1.017	58.77	1.001	58.87	1.038	58.82	0.9993	58.87	1.005	58.87	1.022	58.82	0.9965	58.89	1.019	58.87	1.044
58.06	0.9831	58.38	1.025	58.18	1.013	58.35	1.045	58.39	1.007	58.3	1.017	58.19	1.035	58.42	1.003	58.39	1.027	58.56	1.047
57.04	1.002	57.05	1.043	56.89	1.03	56.97	1.058	56.94	1.029	56.97	1.032	56.98	1.049	56.94	1.021	56.99	1.042	56.98	1.066
56	1.009	56.28	1.049	56.1	1.032	56.25	1.066	56.29	1.036	56.24	1.04	56.11	1.057	56.34	1.023	56.3	1.048	56.46	1.067
53.92	1.027	54.2	1.054	54.02	1.039	54.17	1.073	54.2	1.053	54.15	1.048	54.02	1.068	54.23	1.033	54.21	1.054	54.35	1.078
49.09	1.043	49.34	1.073	49.2	1.056	49.32	1.085	49.34	1.067	49.32	1.064	49.2	1.077	49.39	1.044	49.36	1.066	49.49	1.088
42.15	1.053	42.34	1.086	42.23	1.068	42.34	1.095	42.36	1.073	42.32	1.074	42.24	1.082	42.39	1.055	42.38	1.074	42.48	1.093
34.54	1.061	34.71	1.091	34.6	1.079	34.7	1.098	34.72	1.078	34.69	1.084	34.61	1.088	34.74	1.065	34.74	1.08	34.83	1.099
14.98	1.076	14.98	1.104	14.95	1.098	14.96	1.111	14.95	1.088	14.96	1.095	14.95	1.095	14.95	1.086	14.98	1.085	14.96	1.106
-0.7877	1.09	-0.7723	1.111	-0.7702	1.103	-0.7612	1.115	-0.7882	1.091	-0.7807	1.102	-0.7652	1.106	-0.799	1.097	-0.7812	1.092	-0.7912	1.106
1&2	x	5&6	x	7&8	x	10&11	x	12&13	x	14&15	x	16&17	x	18&19	x	22&23	x	24&25	x
V	I	V	I	V	I	V	I	V	I	V	I	V	I	V	I	V	I	V	I
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

828350-1 Pg T/V
I+V

66.03	0	68.46	0	68.82	0.0021	68.57	0.0021	68.5	0.0011	68.74	0	68.59	0	x	1	0.9682
65.38	0.1886	65.49	0.6824	65.43	0.6759	65.48	0.6457	65.55	0.6592	65.49	0.6628	65.38	0.6458	x	2	1.0166
63.48	0.5962	63.59	0.8914	63.55	0.866	63.58	0.8547	63.65	0.8597	63.59	0.8553	63.48	0.838	x	3	0.9979
59.88	0.9682	61.04	1.022	61.35	0.9789	61.01	0.9936	61.06	0.9887	61.16	0.9733	61.09	0.9604	x	4	1.0375
58.9	1.012	59.97	1.048	59.97	1.014	59.98	1.024	60.03	1.025	59.97	1.009	59.87	0.996	x	5	0.9974
58.83	1.015	59.66	1.057	59.92	1.009	59.62	1.034	59.68	1.028	59.78	1.009	59.7	1	x	6	1.0044
58.78	1.017	58.9	1.070	58.9	1.027	58.9	1.047	58.93	1.048	58.9	1.023	58.9	1.017	x	7	1.0214
57.49	1.053	58.87	1.071	58.83	1.028	58.89	1.047	58.9	1.048	58.88	1.023	58.77	1.02	x	8	0.9947
56.89	1.062	58.29	1.079	58.58	1.037	58.24	1.056	58.31	1.052	58.41	1.023	58.33	1.027	x	9	1.0188
56.16	1.075	56.97	1.088	56.94	1.048	56.99	1.065	57.03	1.07	56.97	1.039	56.89	1.045	x	10	1.0434
54.15	1.091	56.21	1.095	56.49	1.057	56.18	1.072	56.23	1.075	56.34	1.04	56.27	1.048	x	11	1.0119
52.16	1.101	54.11	1.102	54.39	1.069	54.08	1.081	54.14	1.086	54.22	1.06	54.16	1.056	x	12	1.0705
47.45	1.106	49.29	1.108	49.51	1.079	49.25	1.093	49.31	1.0950	49.39	1.082	49.31	1.071	x	13	1.0268
40.77	1.111	42.28	1.117	42.52	1.084	42.27	1.103	42.3	1.099	42.37	1.088	42.34	1.08	x	14	1.0468
33.4	1.113	34.67	1.119	34.86	1.087	34.66	1.105	34.7	1.104	34.74	1.093	34.69	1.086	x	15	1.0482
14.96	1.118	14.95	1.119	14.94	1.089	14.97	1.115	14.96	1.112	14.96	1.102	14.94	1.095	x	16	1.0227
-0.7364	1.123	-0.7668	1.121	-0.8016	1.098	-0.7807	1.122	-0.7774	1.116	-0.7905	1.105	-0.7786	1.097	x	17	1.0172
28&29	x	30&31	x	33&34	x	3&4	x	26&27	x	9&21	x	20&32	x	x	x	17.3445
V	I	V	I	V	I	V	I	V	I	V	I	V	I	x	line item	output at
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	58.9
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	volts

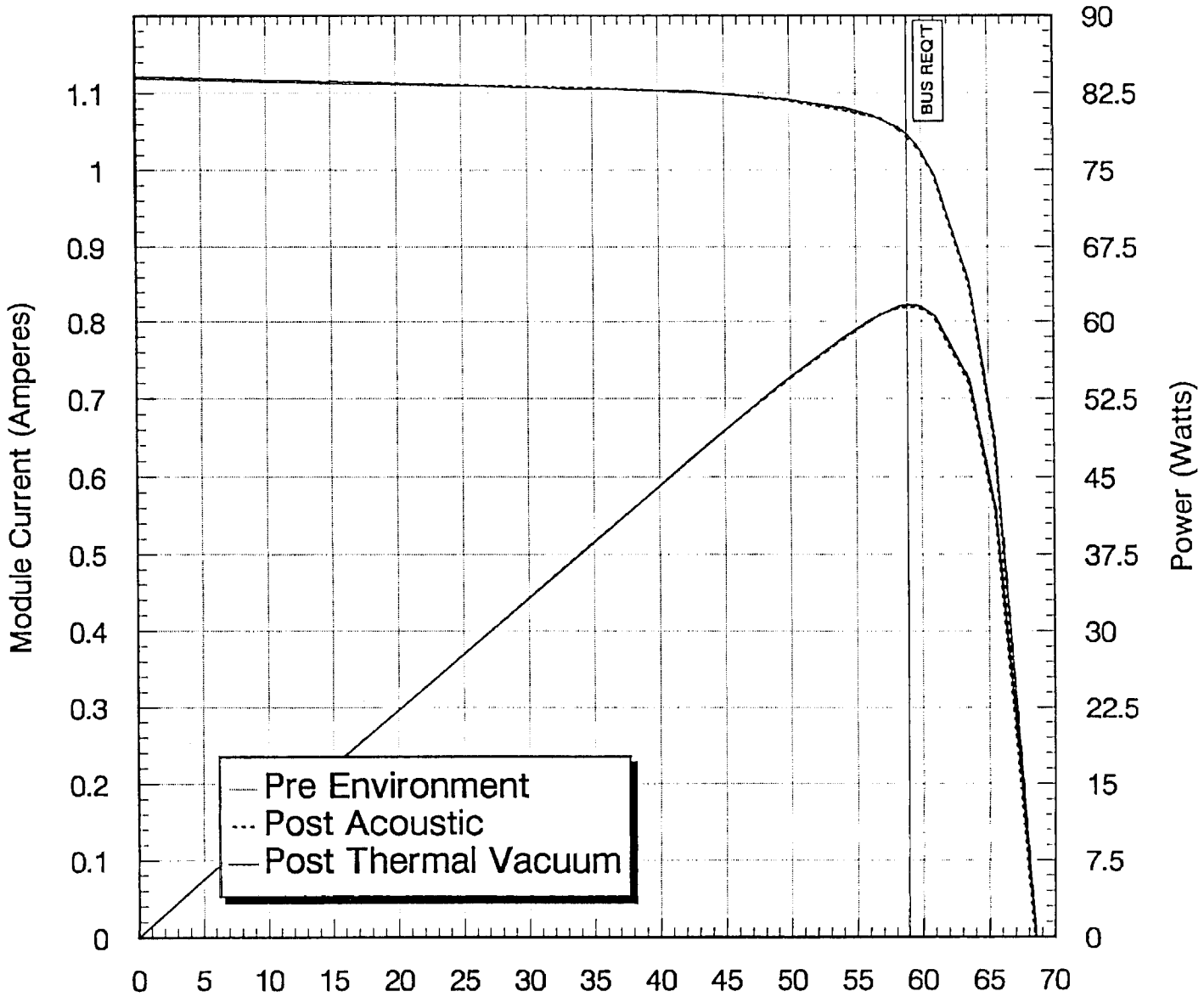
String 1 & 2 Module Outputs for TRMM -Y outer panel (Drawing 828350-1)



(Line Item 1, file 350-0102)

CURRENT GROUPS 7 & 7

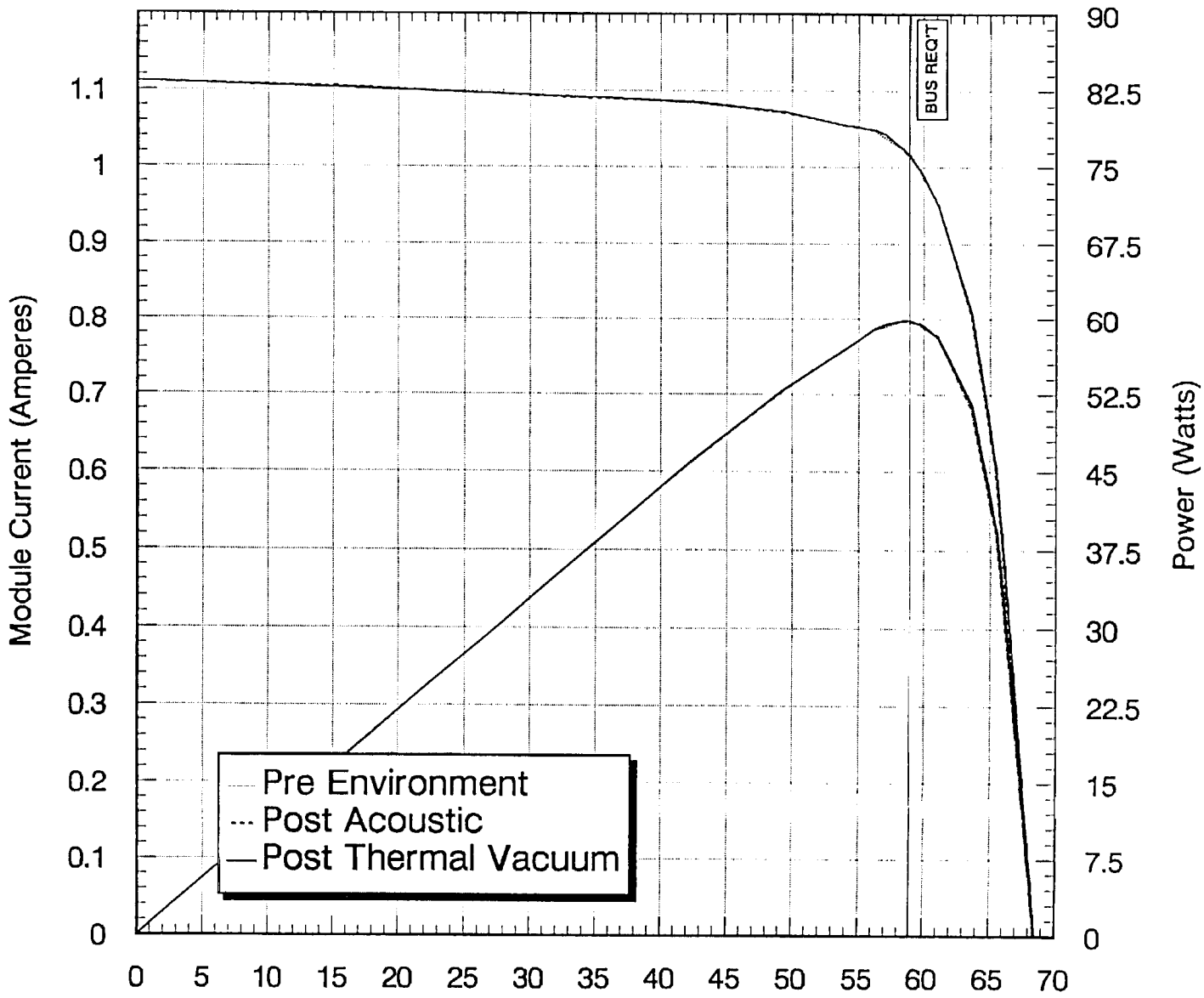
String 3 & 4 Module Outputs for TRMM -Y outer panel (Drawing 828350-1)



(Line Item 14, file 350-0304)

CURRENT GROUPS 10 & 10

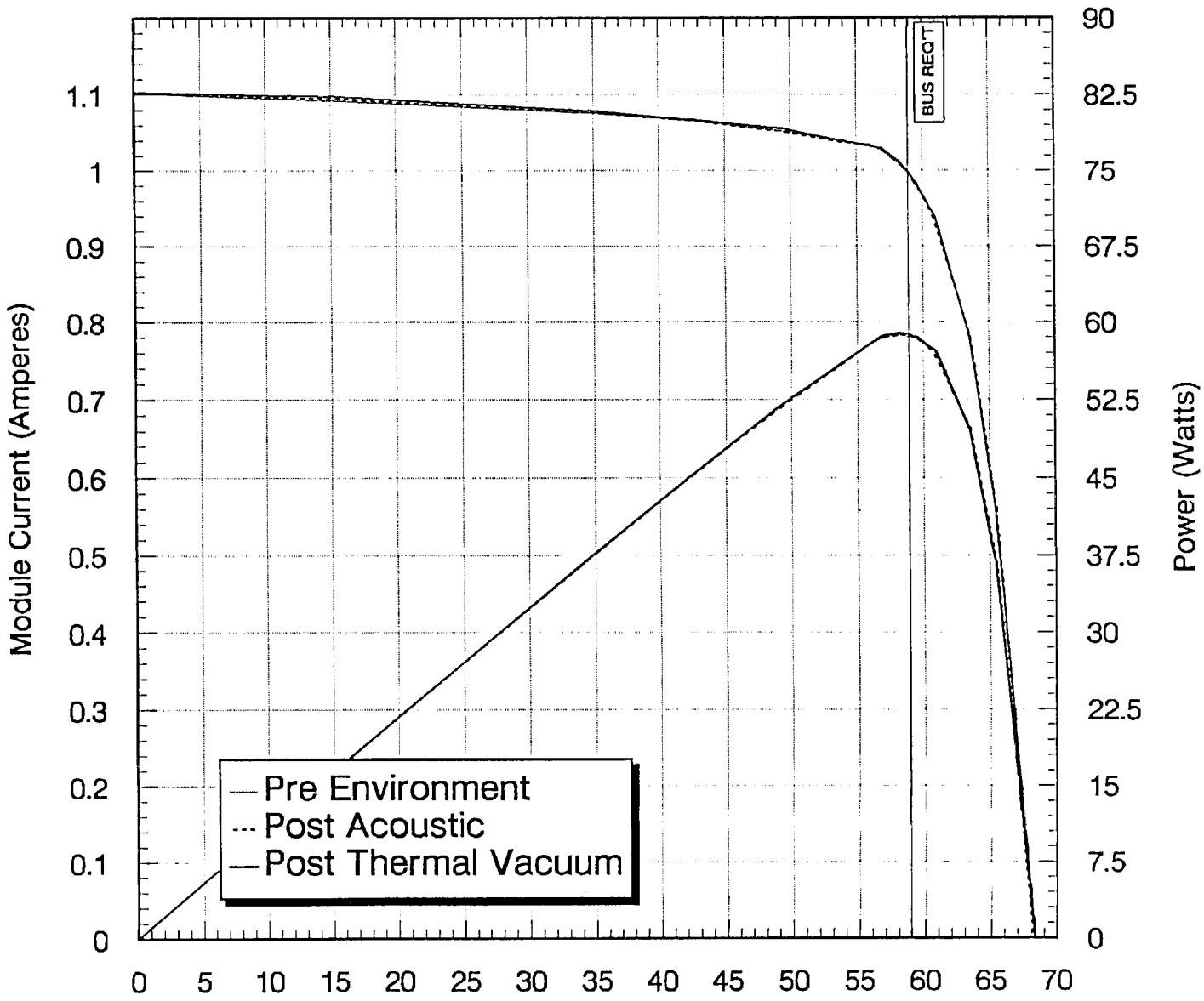
String 5 & 6 Module Outputs for TRMM -Y outer panel (Drawing 828350-1)



(Line Item 2, file 350-0506)

CURRENT GROUPS 8 & 9

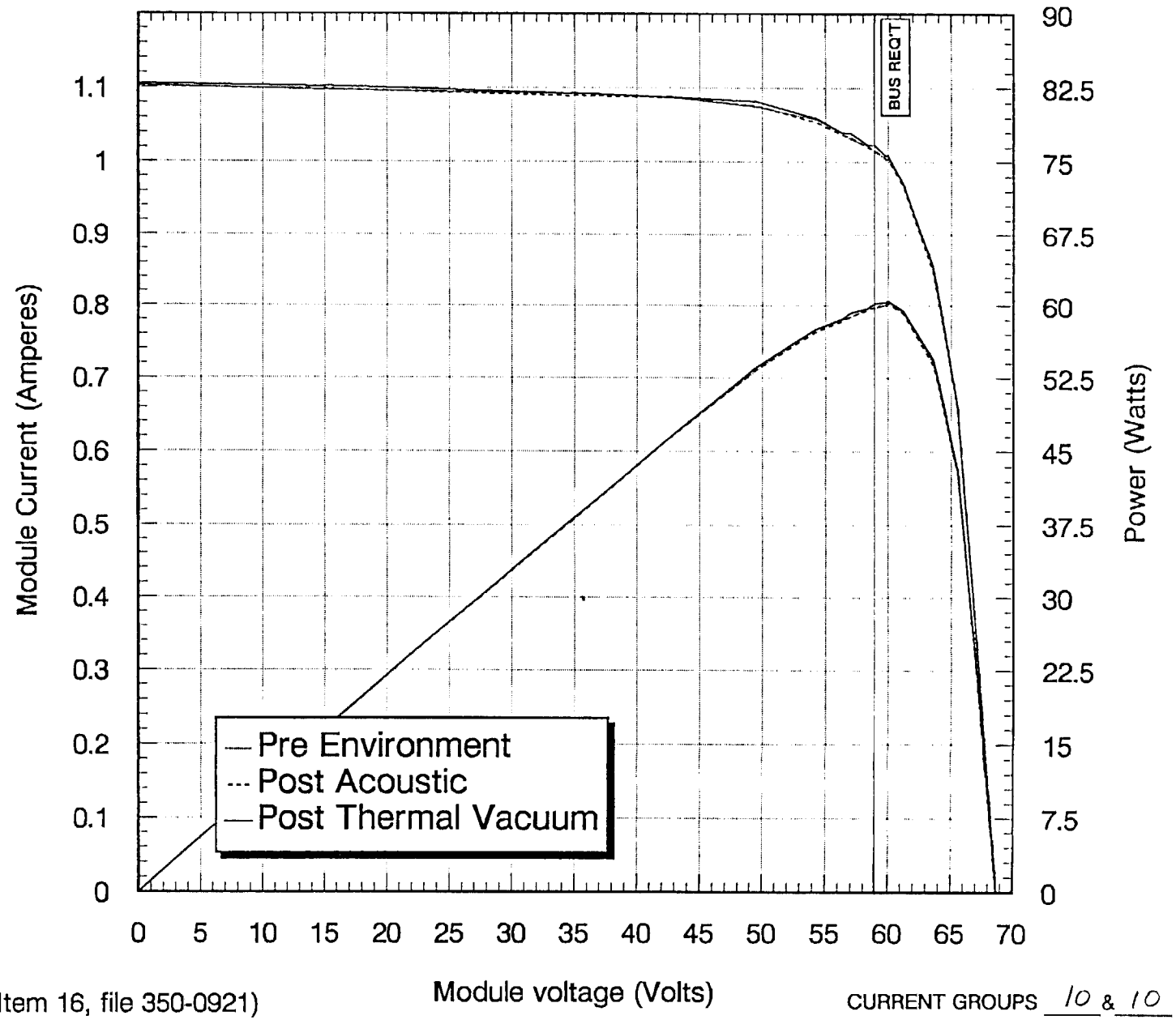
String 7 & 8 Module Outputs for TRMM -Y outer panel (Drawing 828350-1)



(Line Item 3, file 350-0708)

CURRENT GROUPS 8 & 8

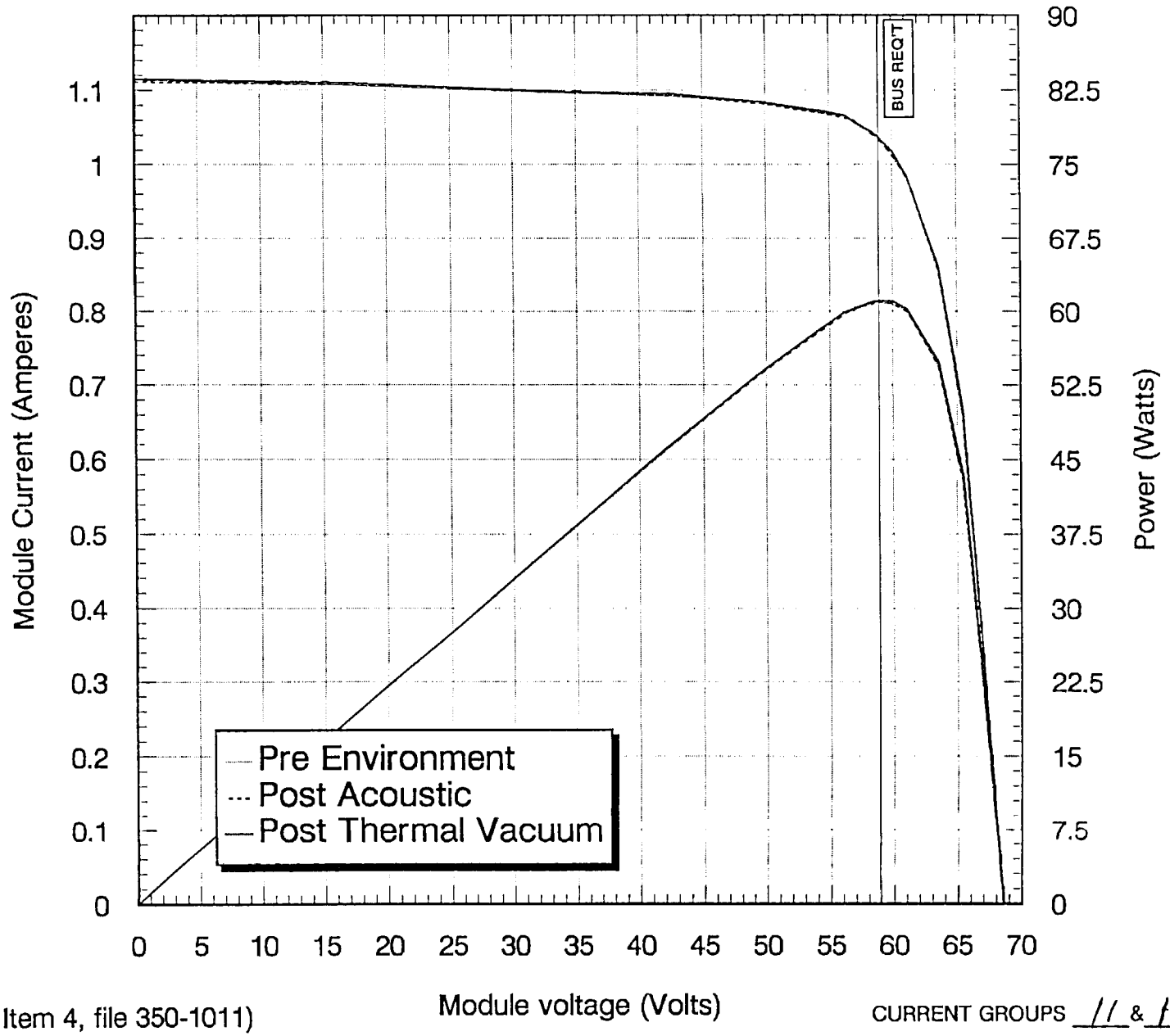
String 9 & 21 Module Outputs for TRMM -Y outer panel (Drawing 828350-1)



(Line Item 16, file 350-0921)

CURRENT GROUPS 10 & 10

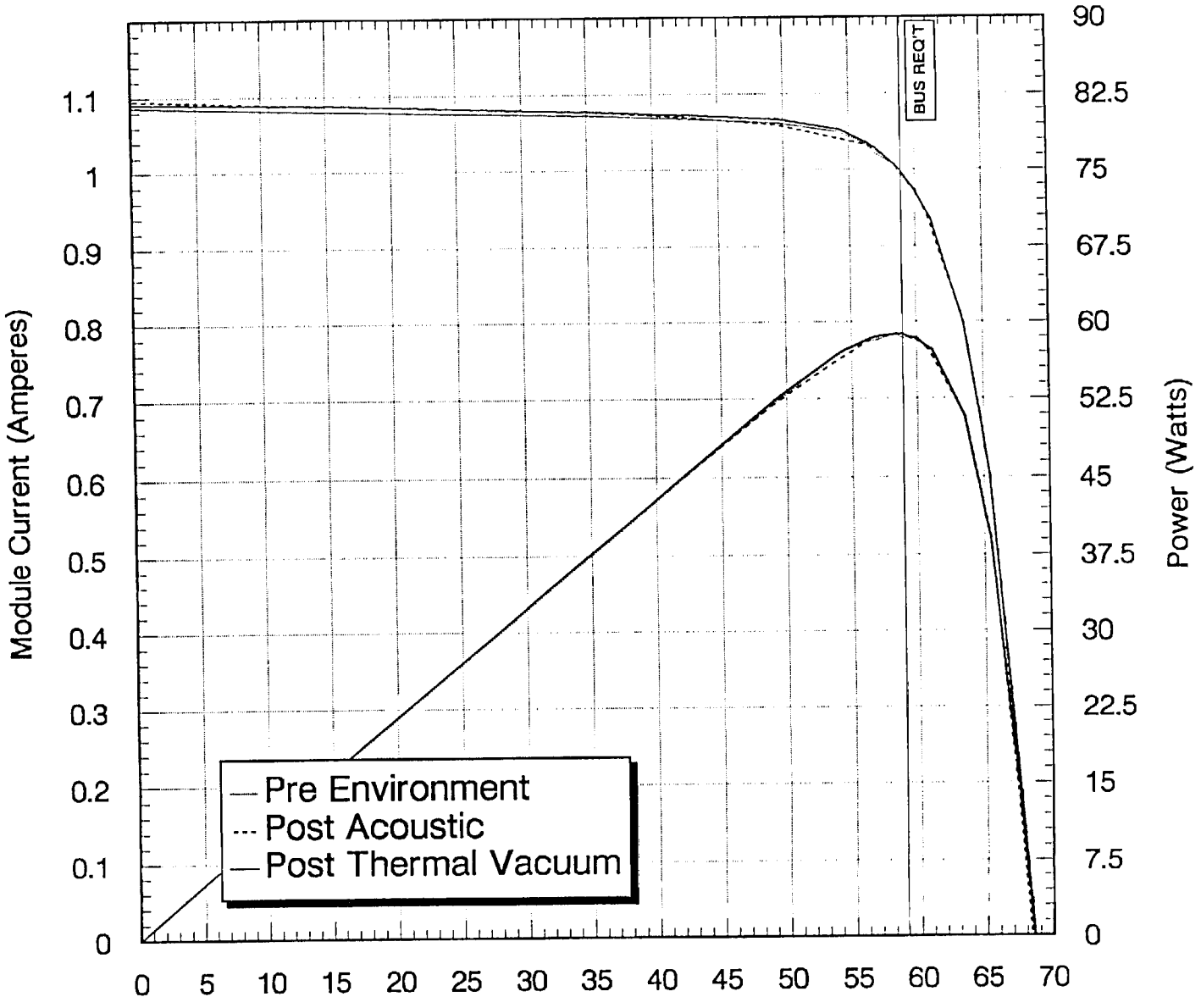
String 10 & 11 Module Outputs for TRMM -Y outer panel (Drawing 828350-1)



(Line Item 4, file 350-1011)

CURRENT GROUPS 11 & 11

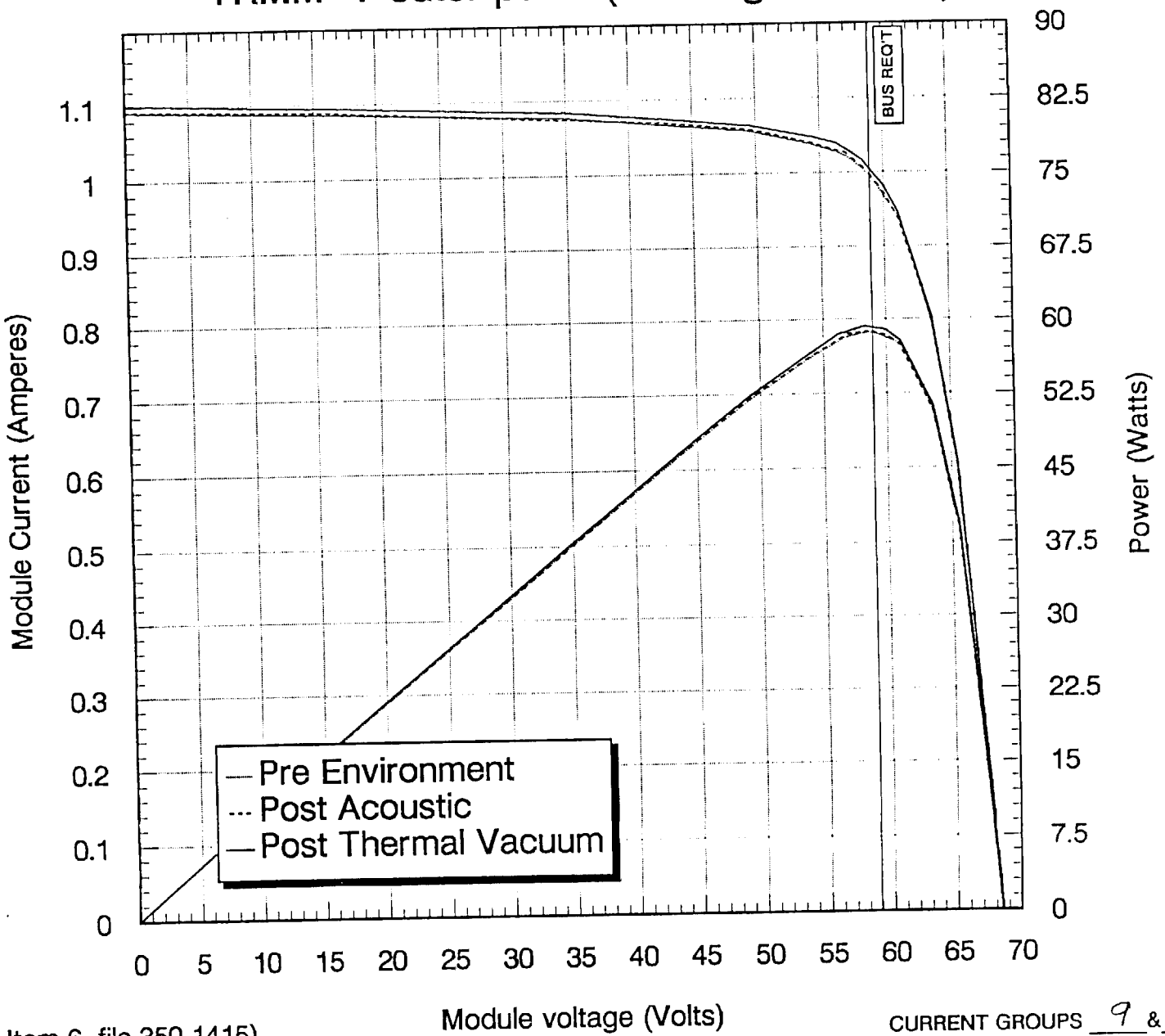
String 12 & 13 Module Outputs for TRMM -Y outer panel (Drawing 828350-1)



(Line Item 5, file 350-1213)

CURRENT GROUPS 9 & 9

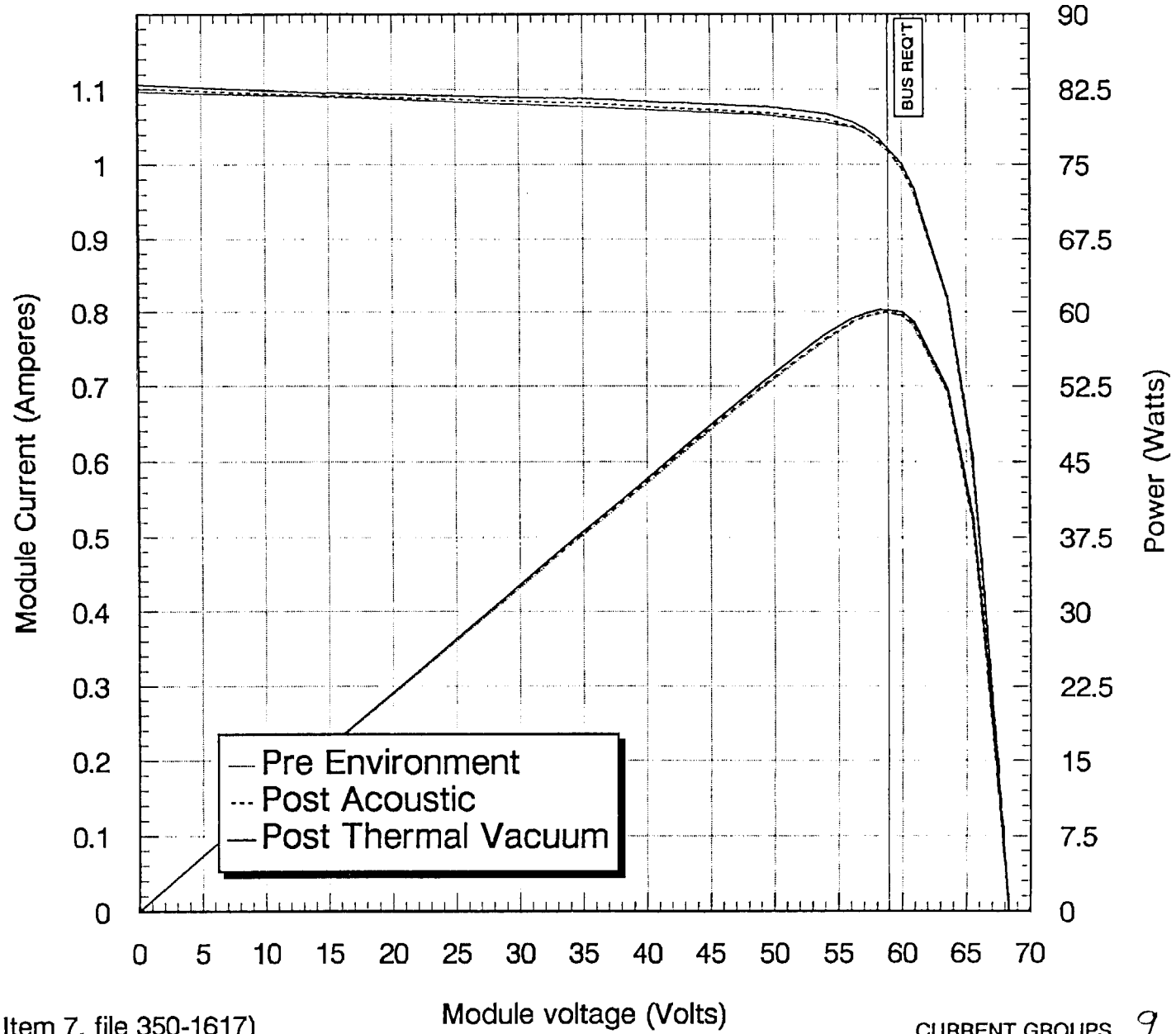
String 14 & 15 Module Outputs for TRMM -Y outer panel (Drawing 828350-1)



(Line Item 6, file 350-1415)

CURRENT GROUPS 9 & 9

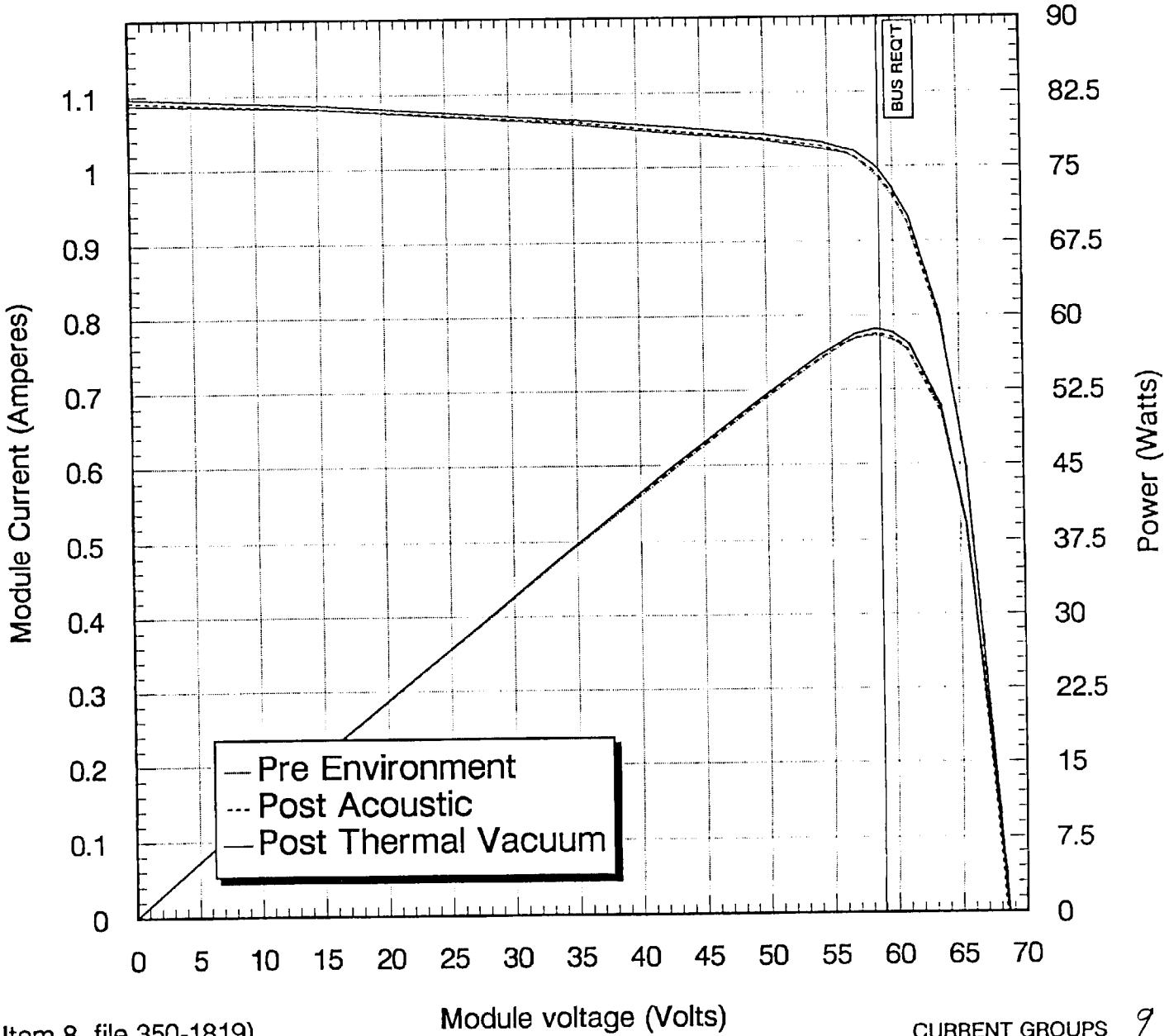
String 16 & 17 Module Outputs for TRMM -Y outer panel (Drawing 828350-1)



(Line Item 7, file 350-1617)

CURRENT GROUPS 9 & 9

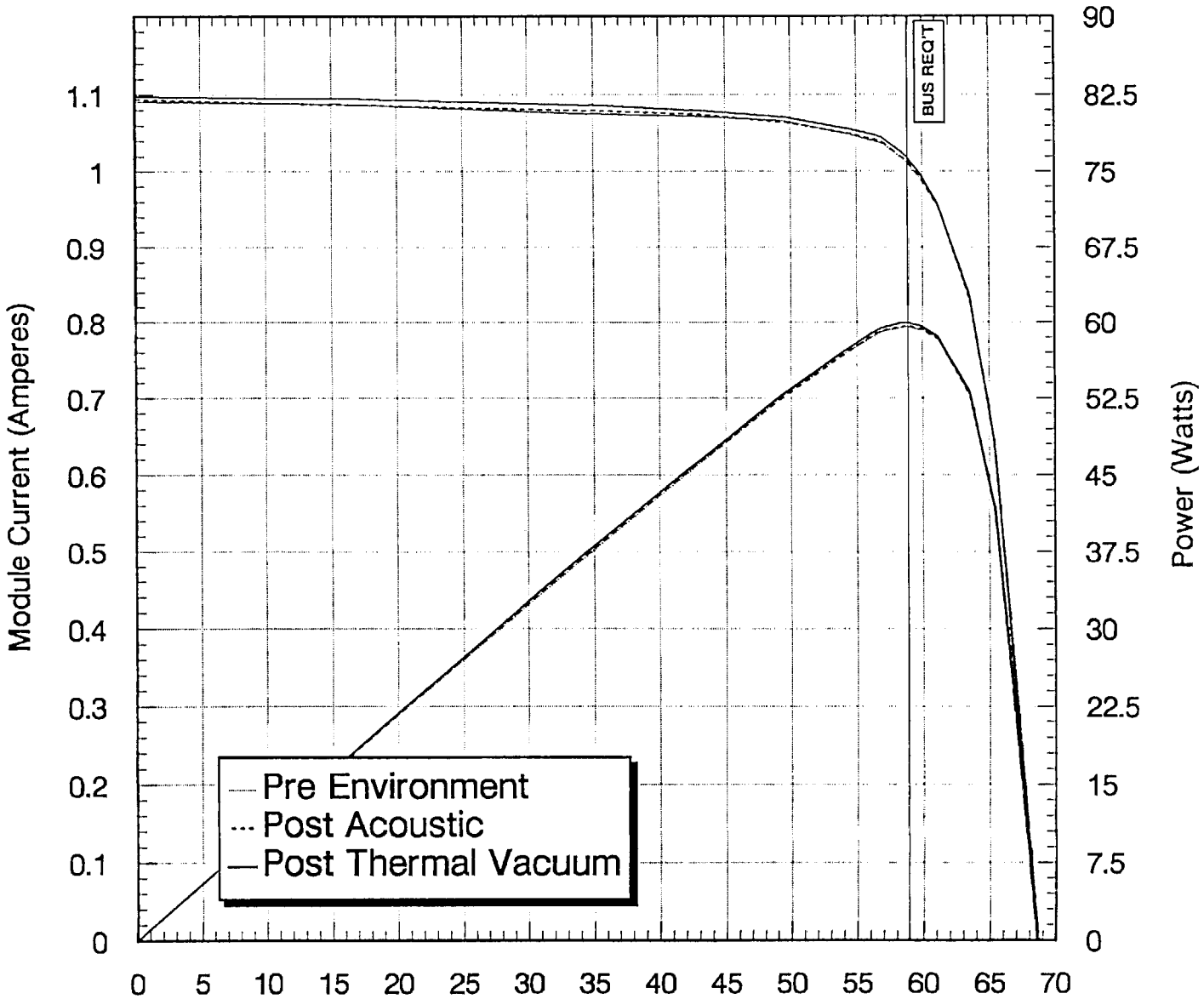
String 18 & 19 Module Outputs for TRMM -Y outer panel (Drawing 828350-1)



(Line Item 8, file 350-1819)

CURRENT GROUPS 9 & 9

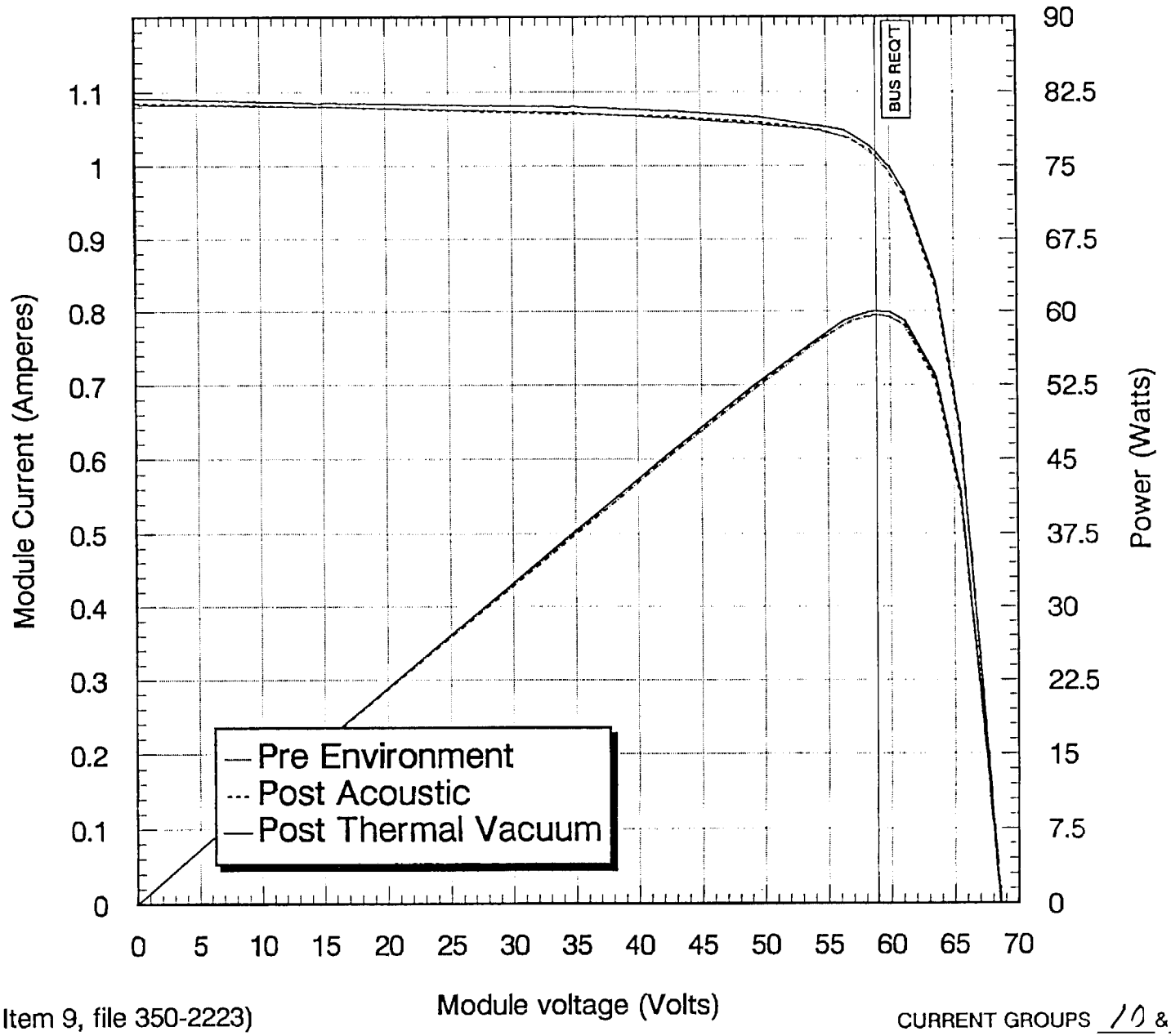
String 20 & 32 Module Outputs for TRMM -Y outer panel (Drawing 828350-1)



(Line Item 17, file 340-2032)

CURRENT GROUPS 9 & 12

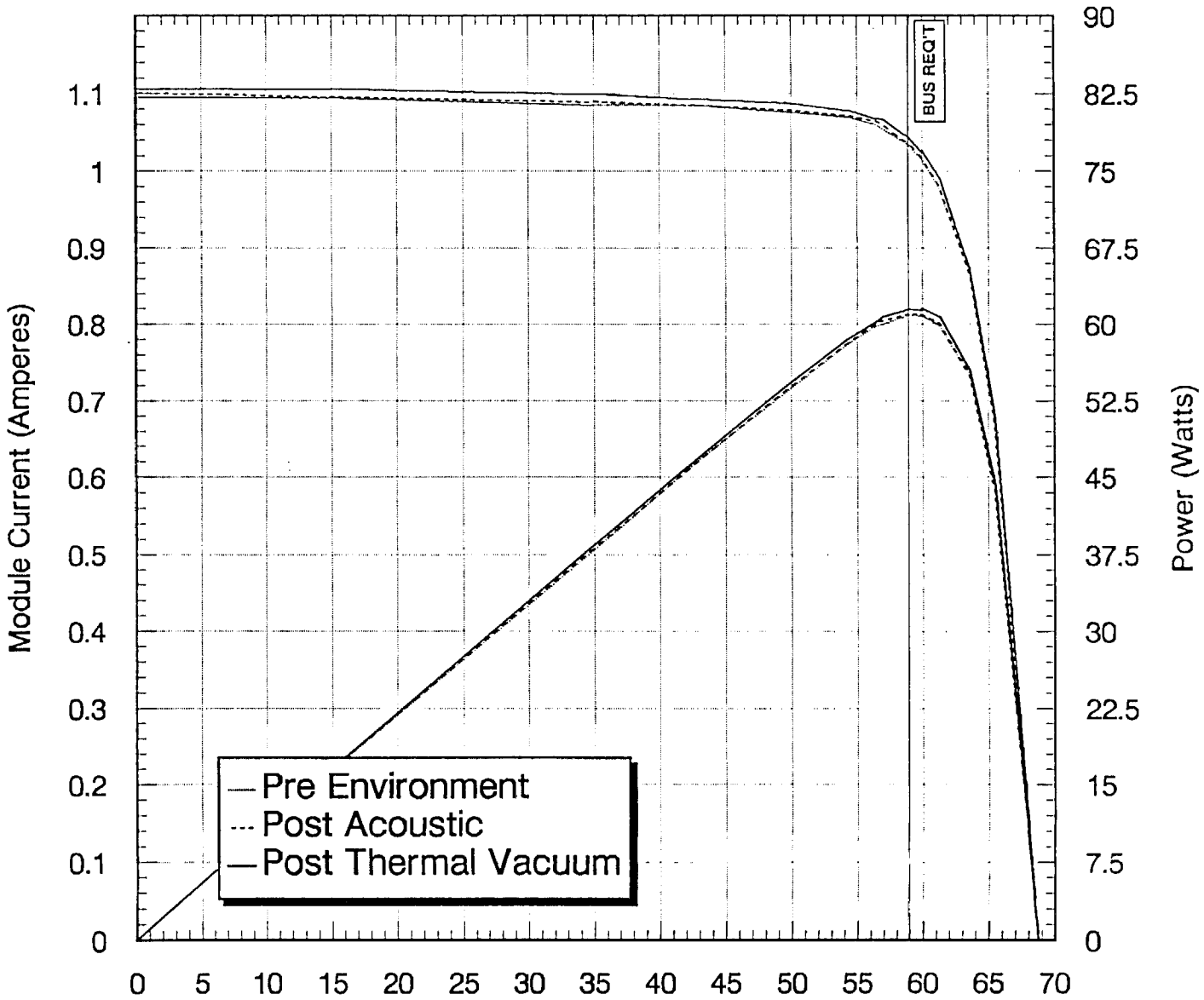
String 22 & 23 Module Outputs for TRMM -Y outer panel (Drawing 828350-1)



(Line Item 9, file 350-2223)

CURRENT GROUPS 10 & 10

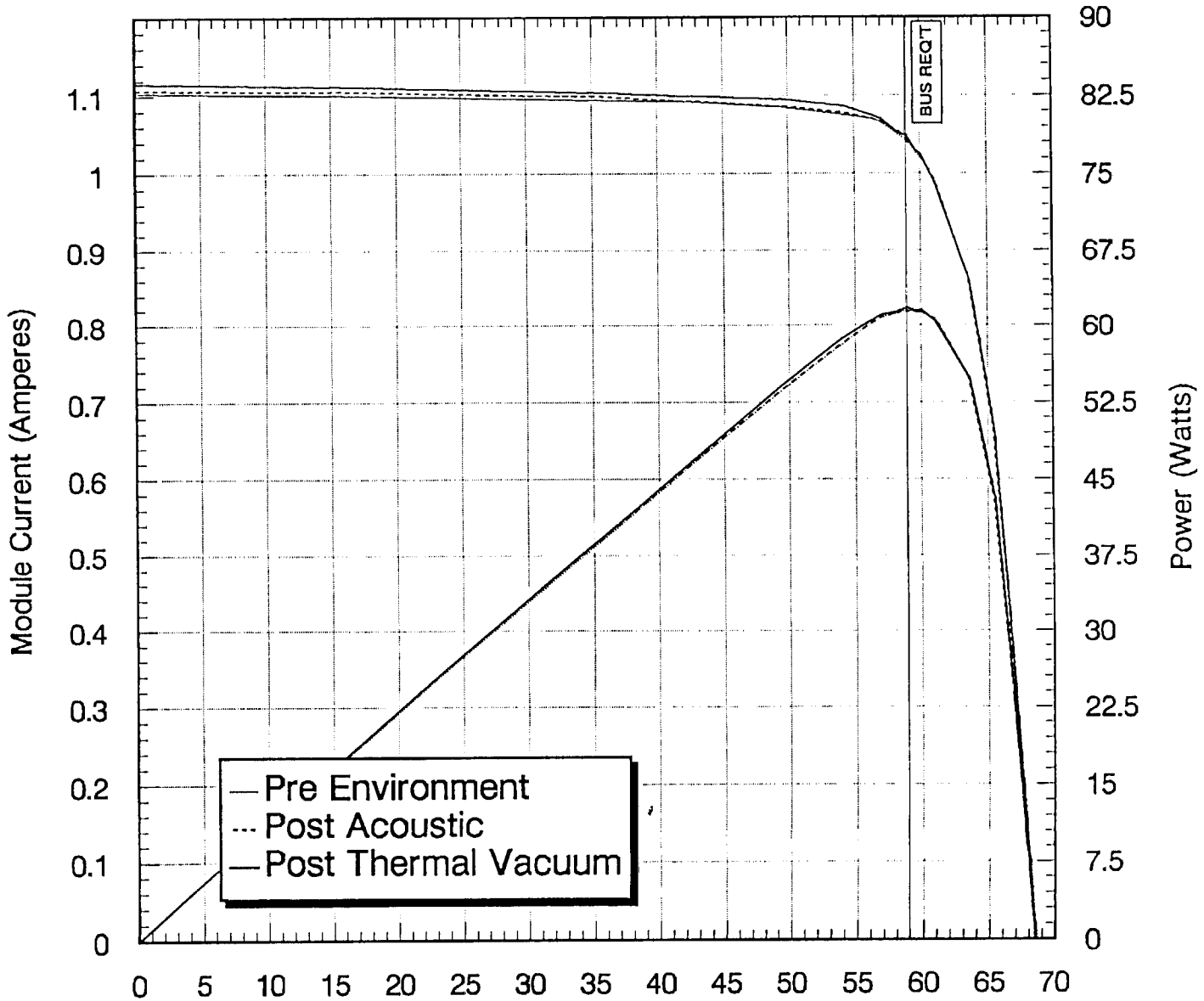
String 24 & 25 Module Outputs for TRMM -Y outer panel (Drawing 828350-1)



(Line Item 10, file 350-2425)

CURRENT GROUPS 13 & 13

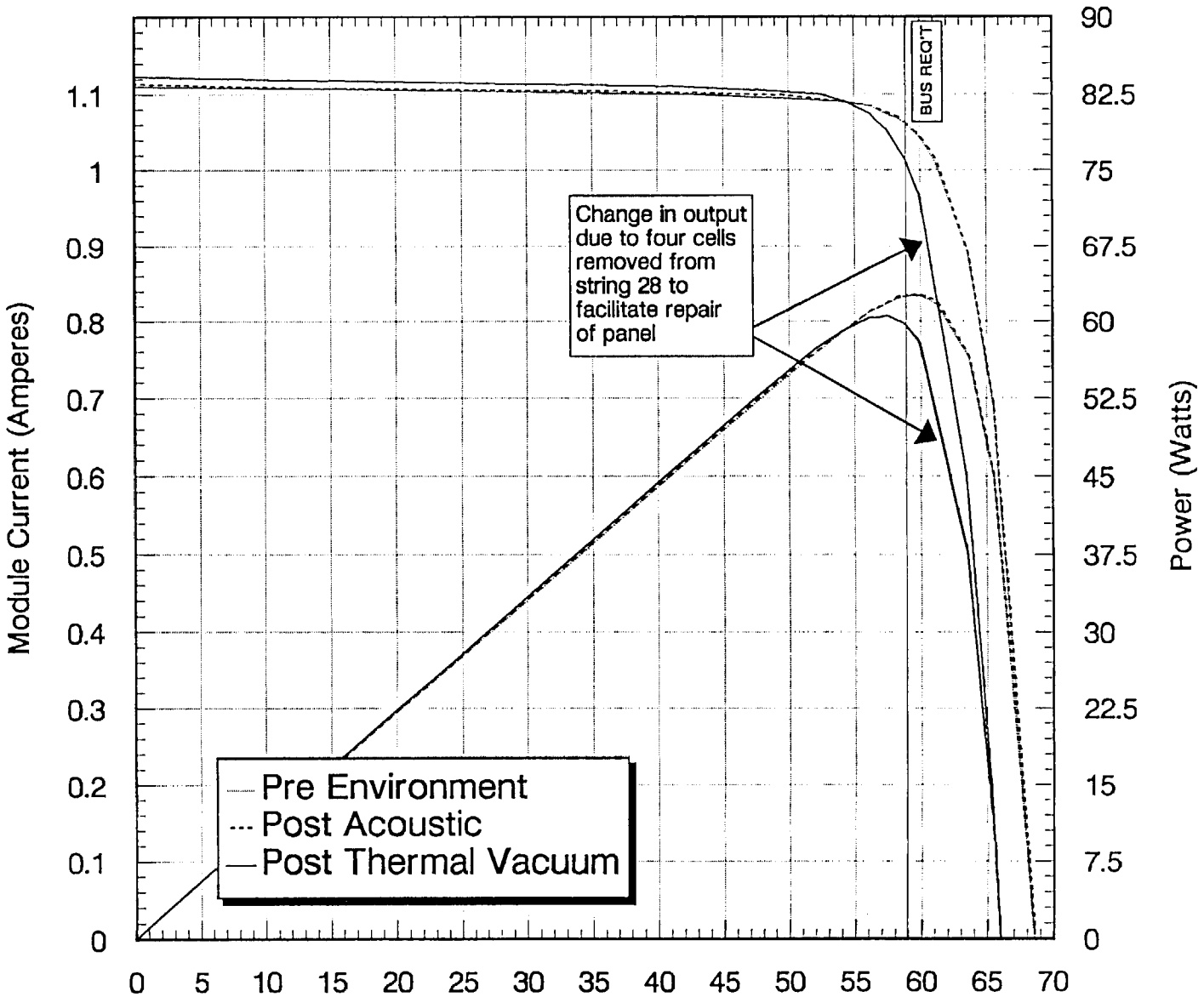
String 26 & 27 Module Outputs for TRMM -Y outer panel (Drawing 828350-1)



(Line Item 15, file 350-2627)

CURRENT GROUPS 12 & 11

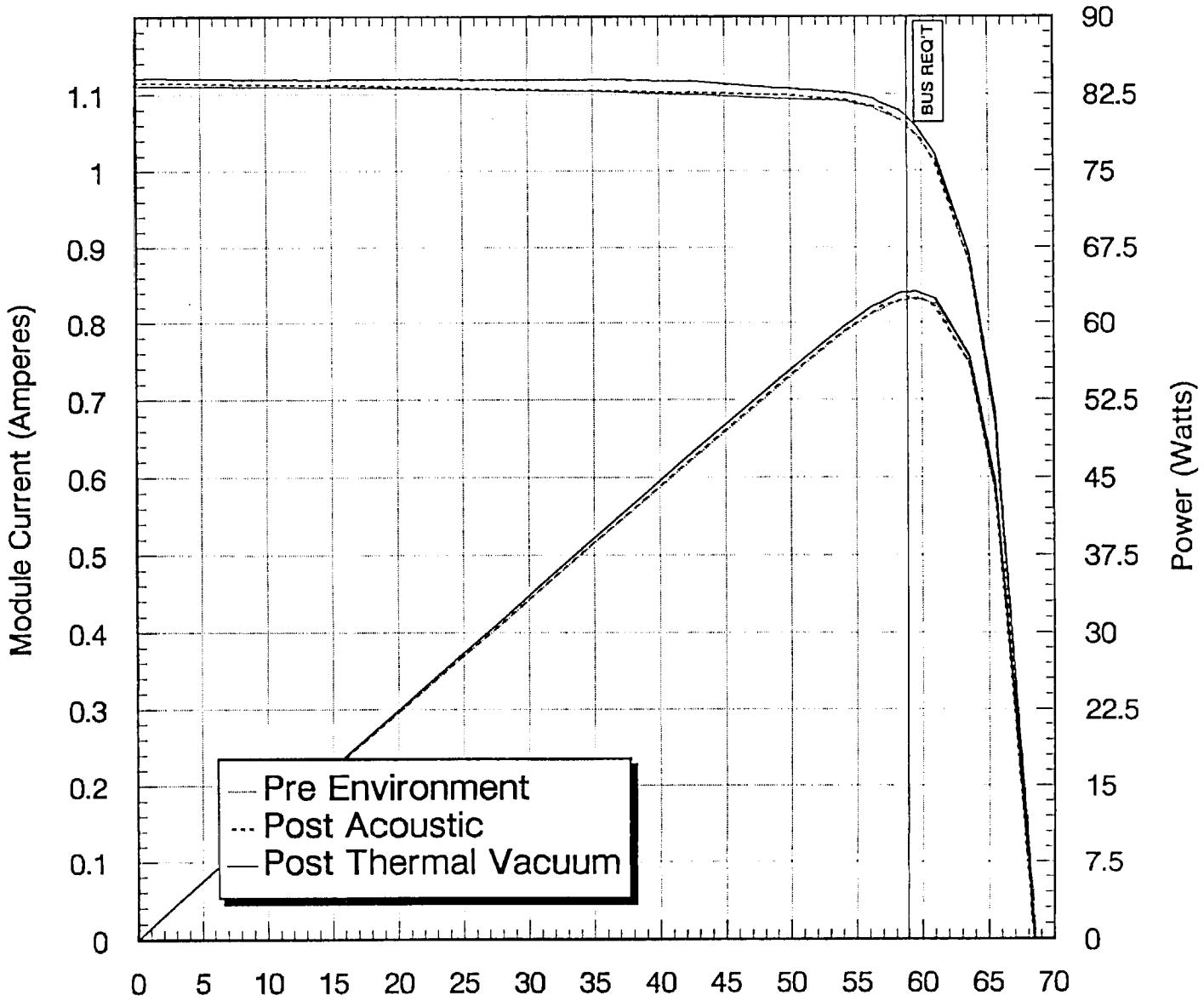
String 28 & 29 Module Outputs for TRMM -Y outer panel (Drawing 828350-1)



(Line Item 11, file 350-2829)

CURRENT GROUPS 14 & 14

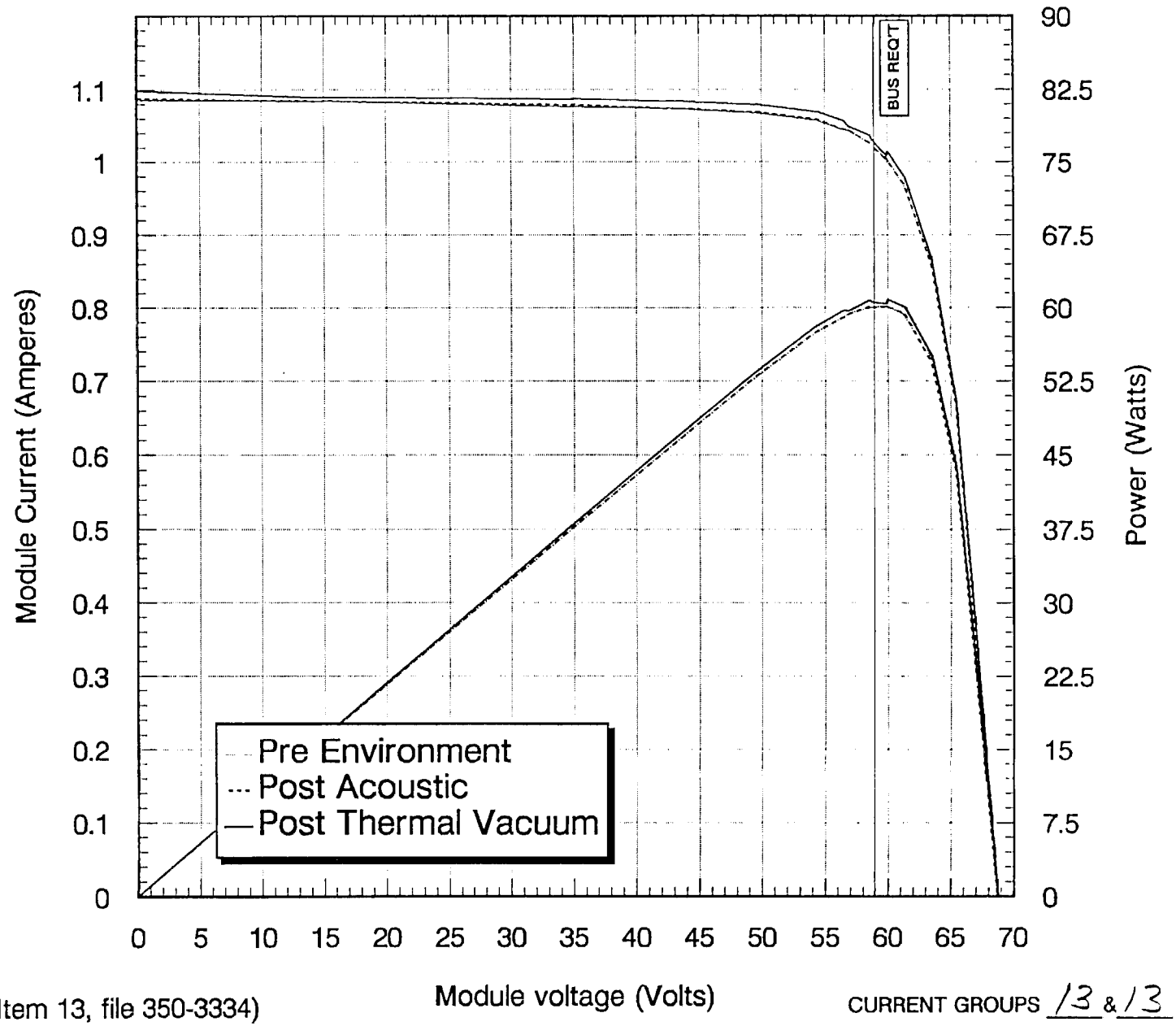
String 30 & 31 Module Outputs for TRMM -Y outer panel (Drawing 828350-1)



(Line Item 12, file 350-3031)

CURRENT GROUPS 14 & 14

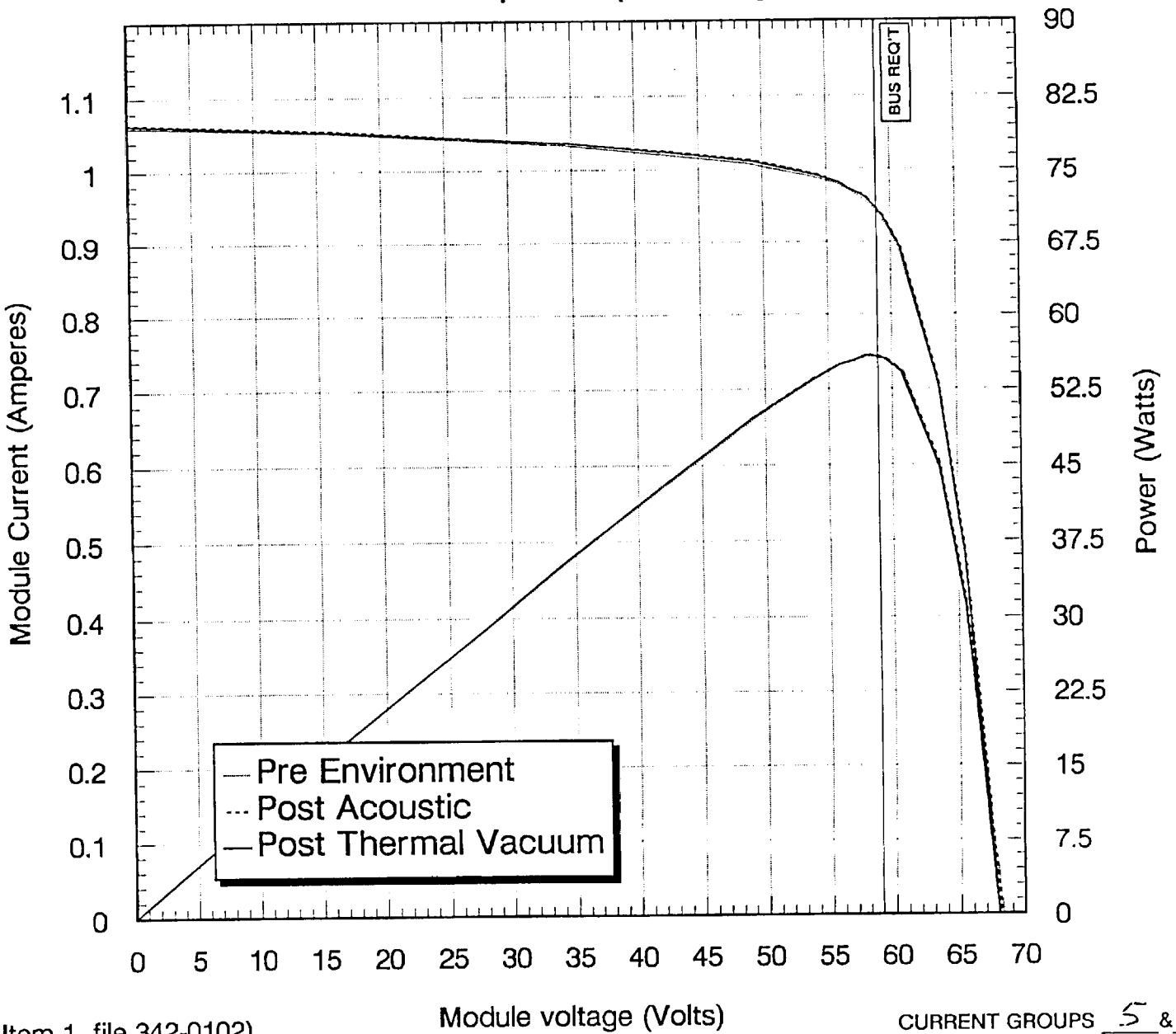
String 33 & 34 Module Outputs for TRMM -Y outer panel (Drawing 828350-1)



(Line Item 13, file 350-3334)

CURRENT GROUPS 13 & 13

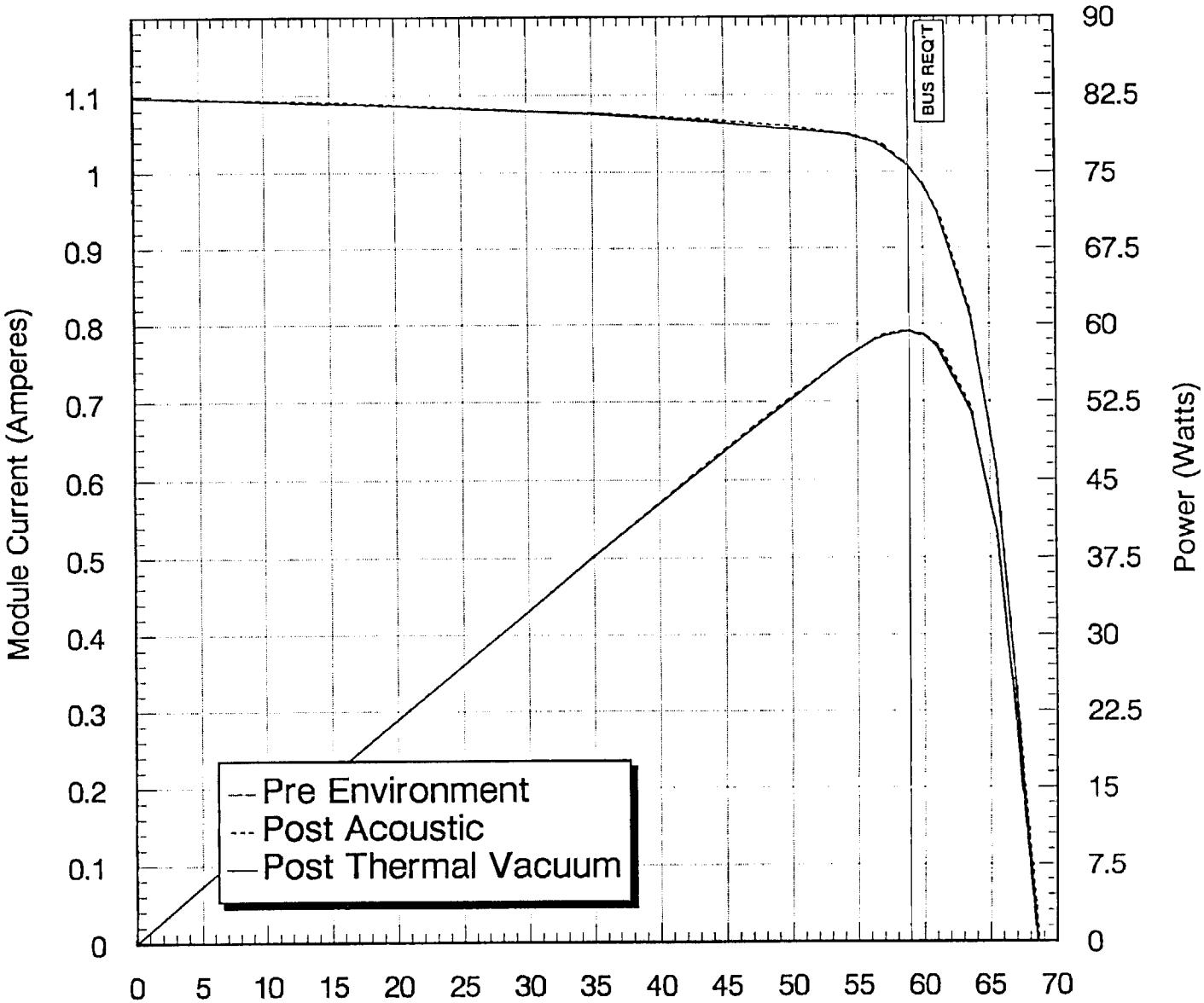
String 1 & 2 Module Outputs for TRMM -Y outer panel (Drawing 828340-2)



(Line Item 1, file 342-0102)

CURRENT GROUPS 5 & 6

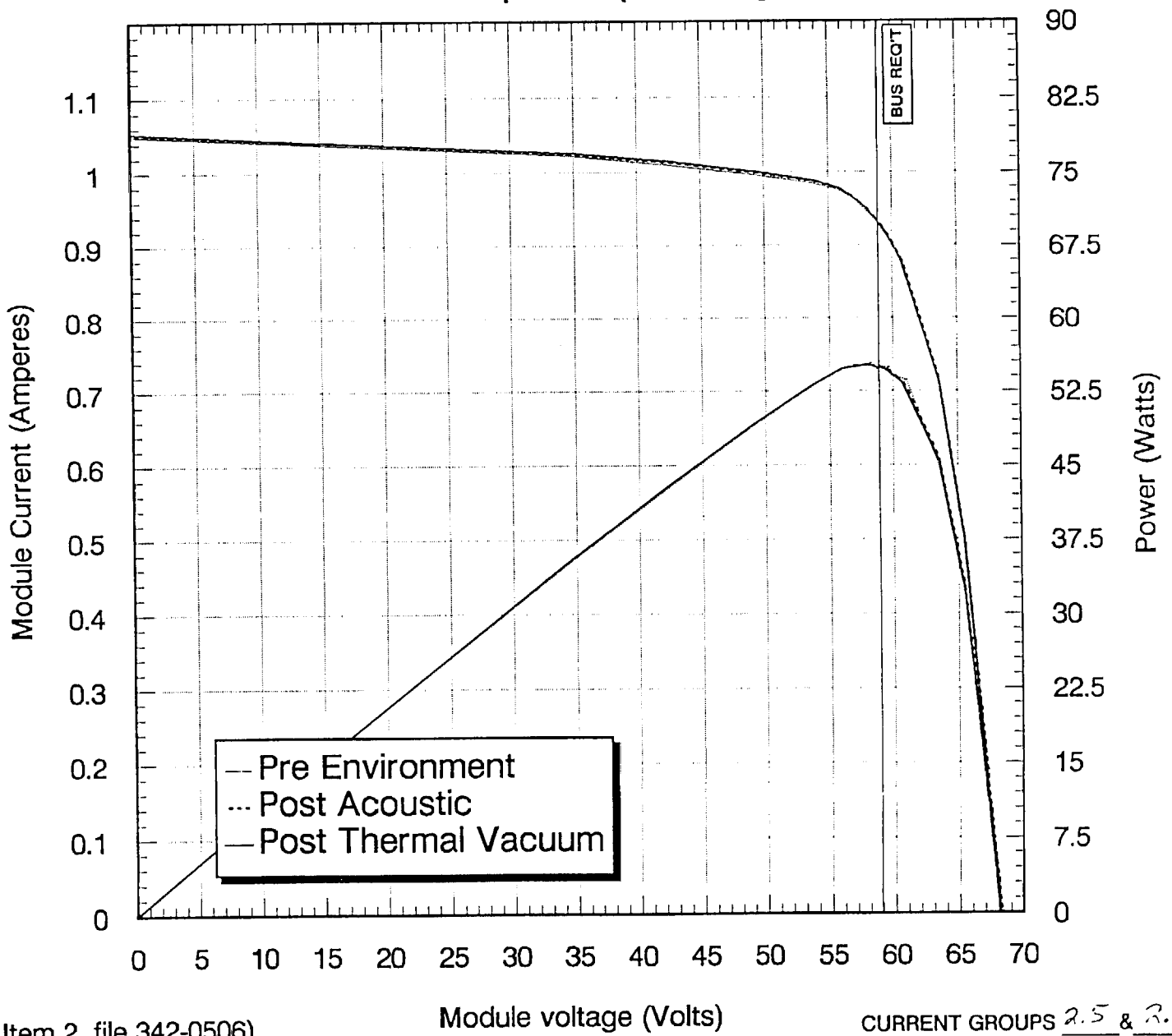
String 3 & 4 Module Outputs for TRMM -Y outer panel (Drawing 828340-2)



(Line Item 14, file 342-0304)

CURRENT GROUPS 7 & 89

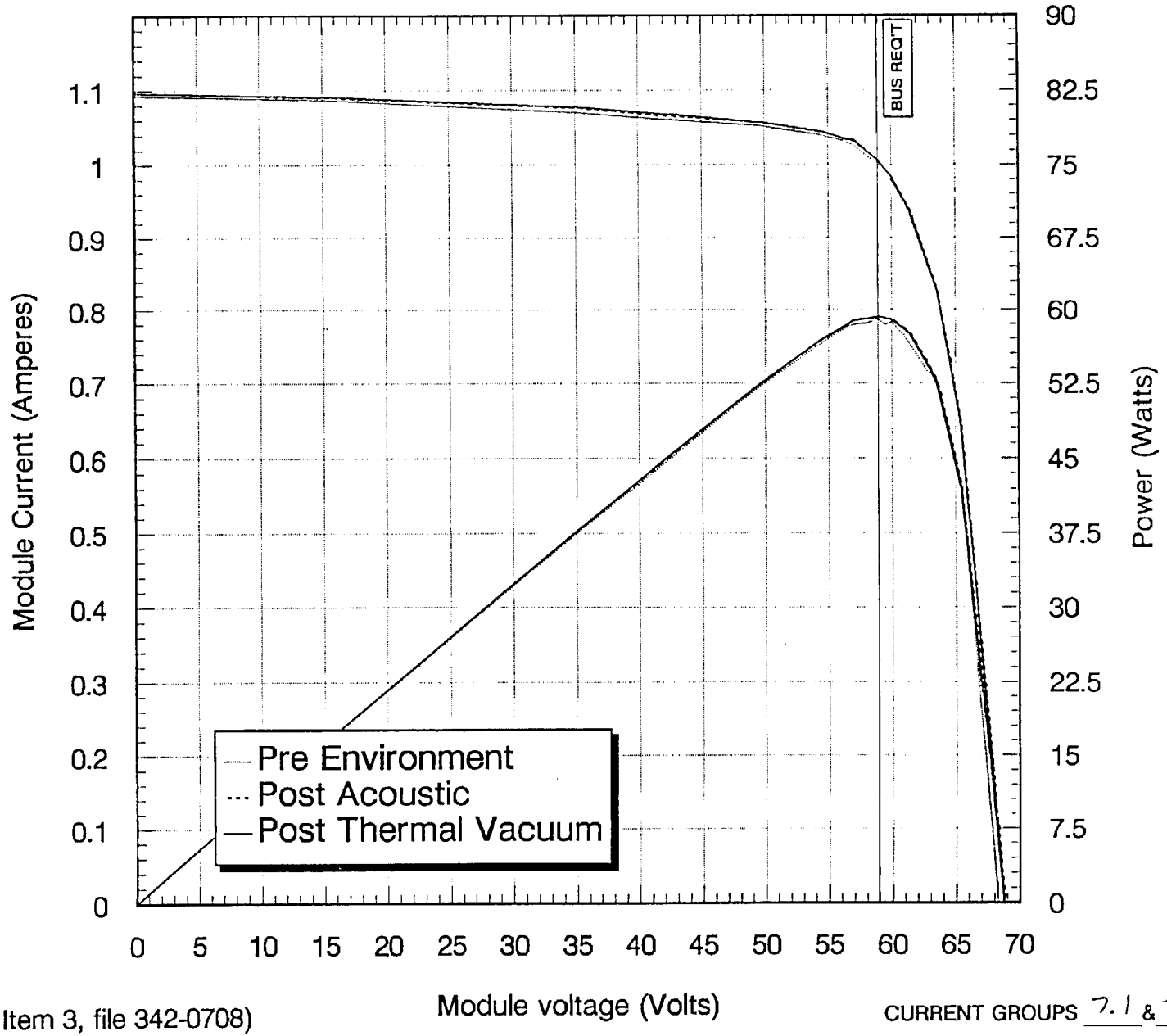
String 5 & 6 Module Outputs for TRMM -Y outer panel (Drawing 828340-2)



(Line Item 2, file 342-0506)

CURRENT GROUPS 2.5 & 2.5 AVERAGE
USED 1, 2, 3, 4

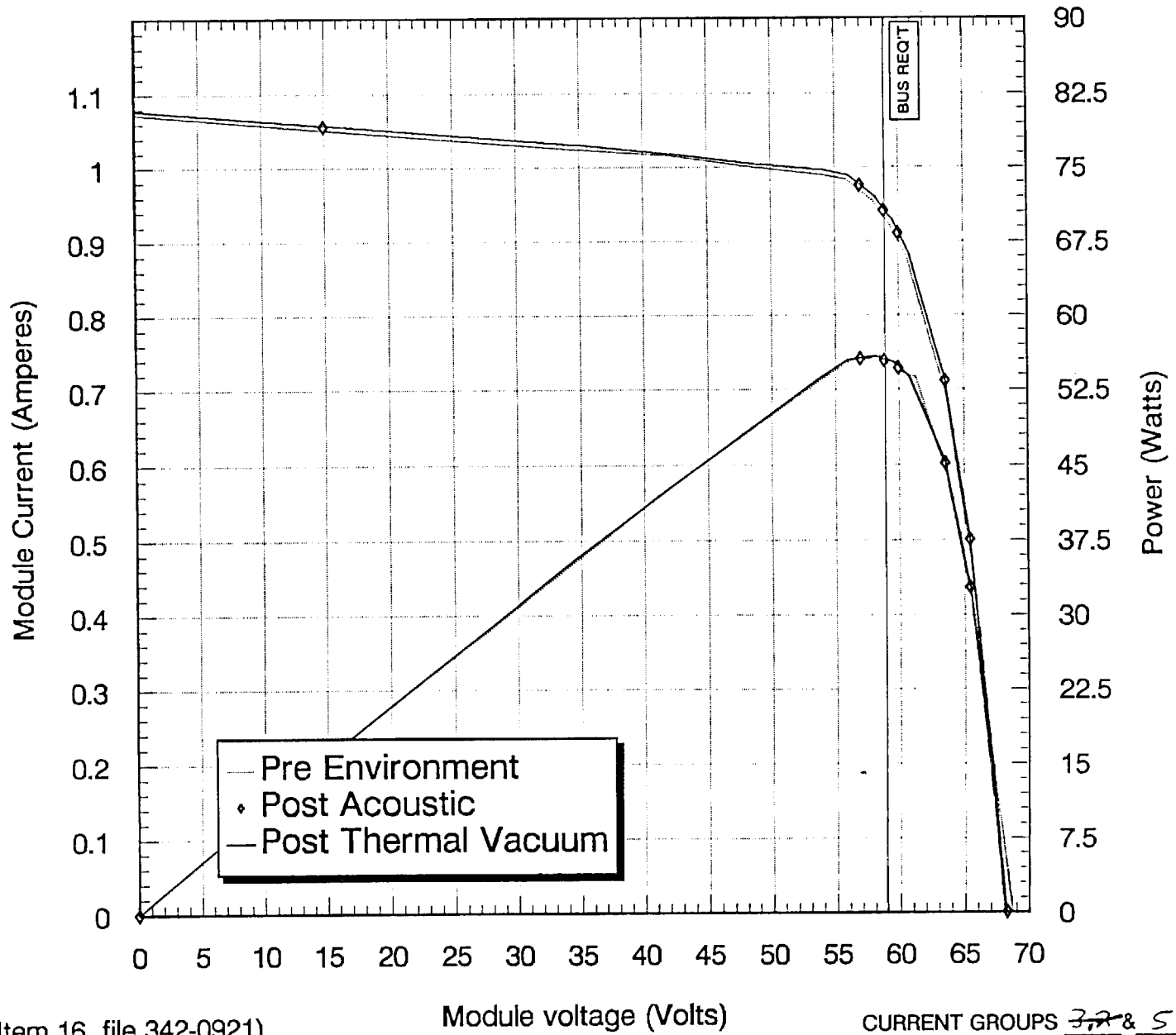
String 7 & 8 Module Outputs for TRMM -Y outer panel (Drawing 828340-2)



(Line Item 3, file 342-0708)

CURRENT GROUPS 7.1 & 7.1 Average
used 5, 6, 7, 8, 9

String 9 & 21 Module Outputs for TRMM -Y outer panel (Drawing 828340-2)

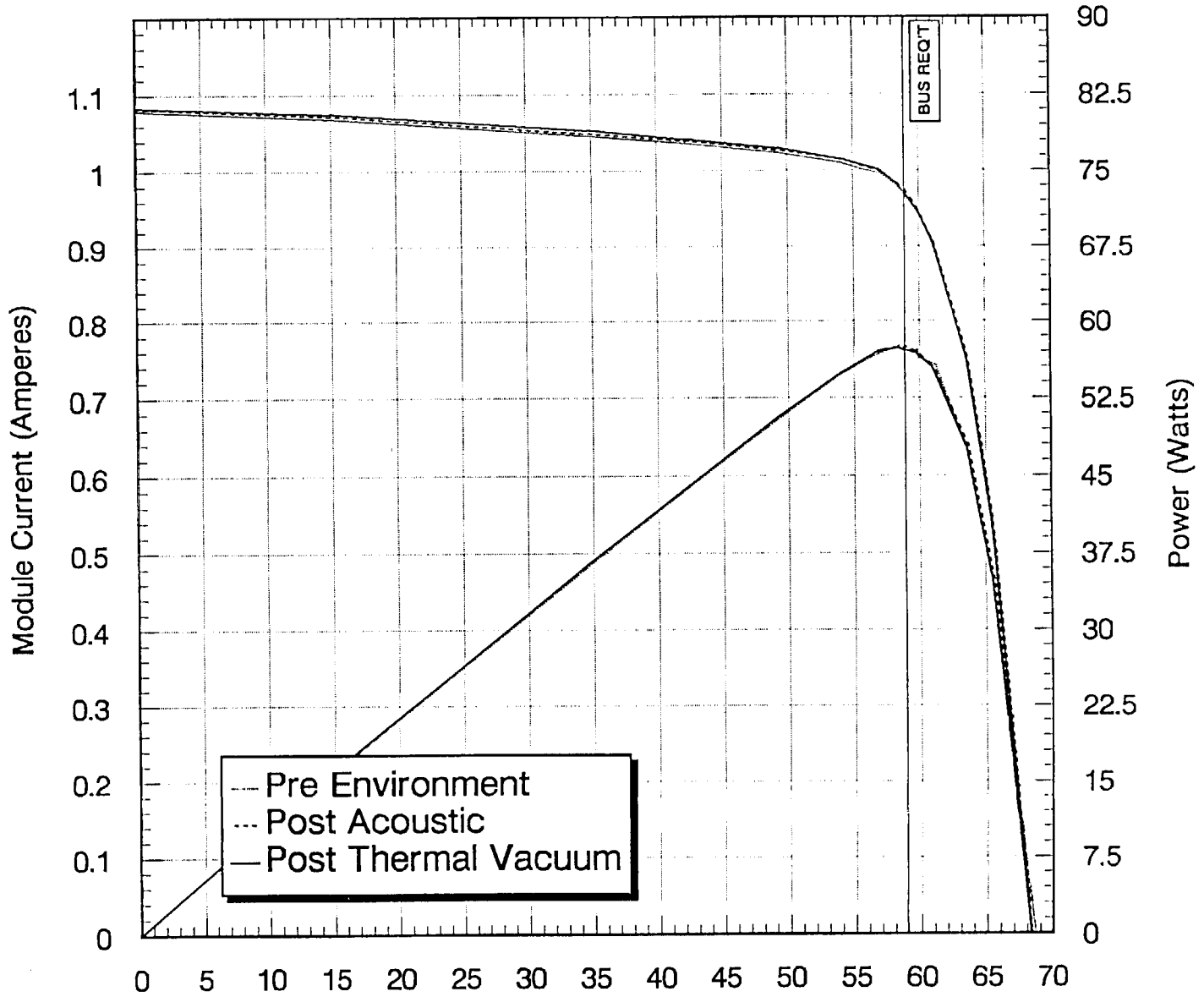


(Line Item 16, file 342-0921)

CURRENT GROUPS ~~3,4~~ & 5

used 1, 2, 3

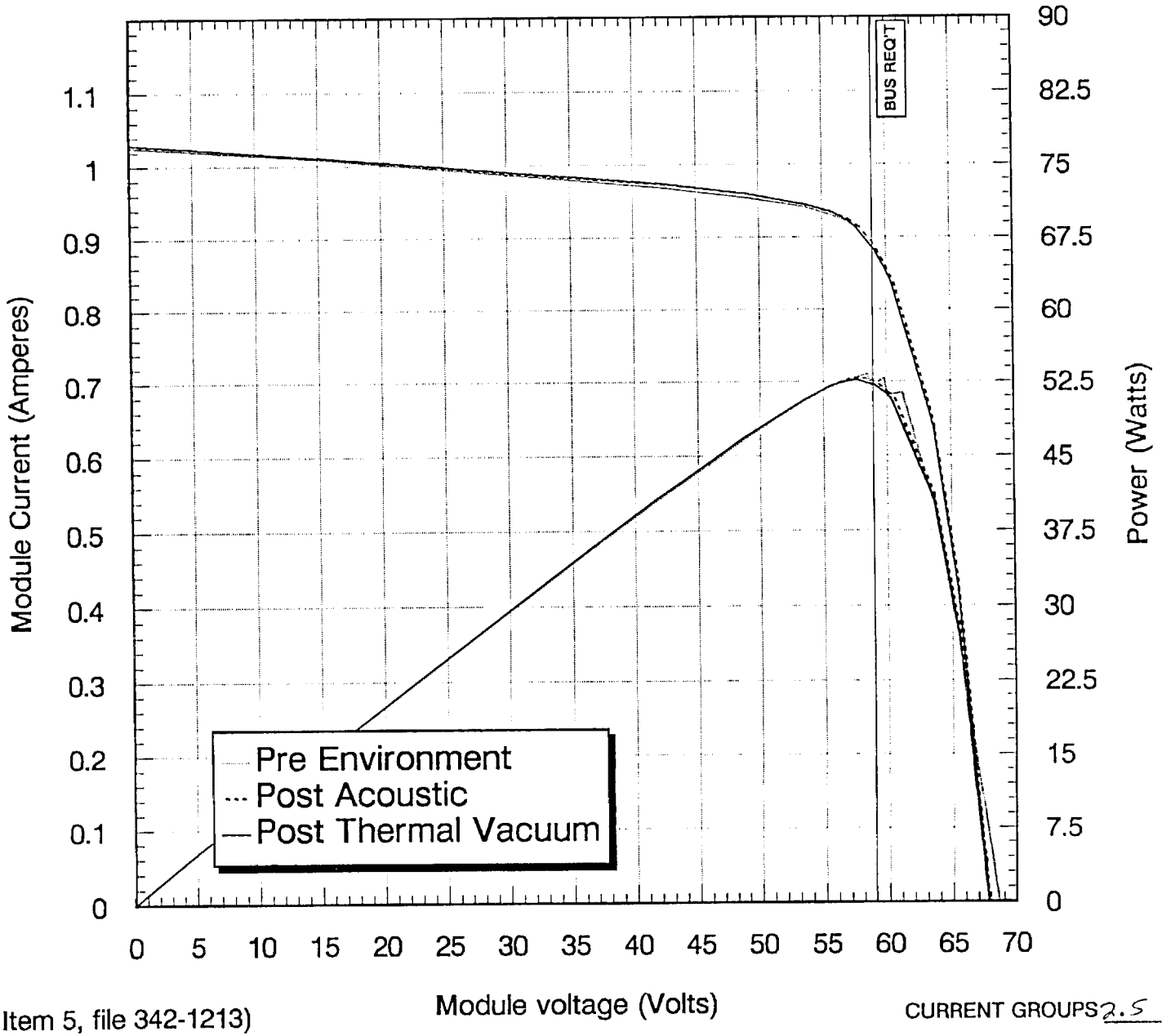
String 10 & 11 Module Outputs for TRMM -Y outer panel (Drawing 828340-2)



(Line Item 4, file 342-1011)

CURRENT GROUPS 7 & 6

String 12 & 13 Module Outputs for TRMM -Y outer panel (Drawing 828340-2)

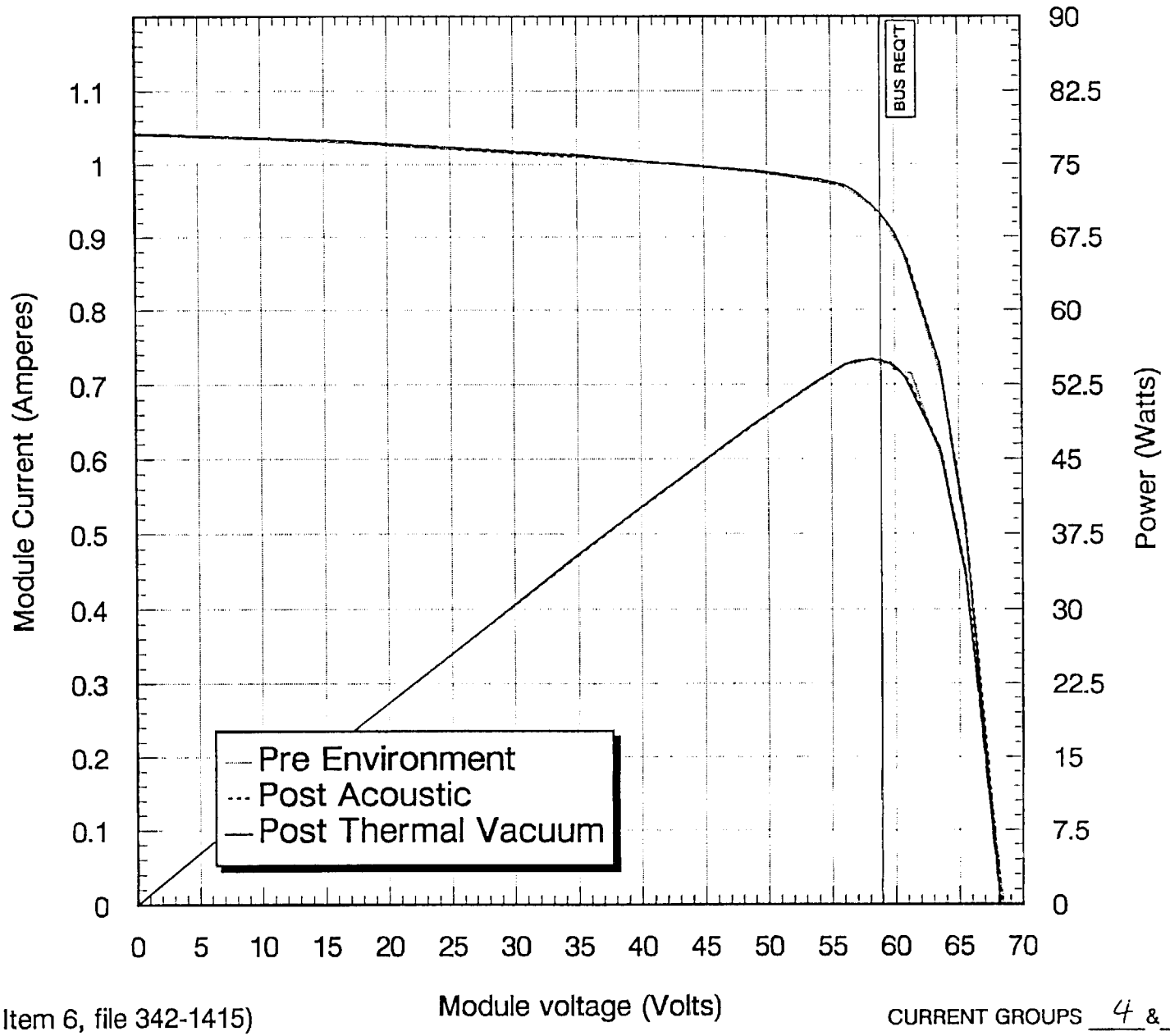


(Line Item 5, file 342-1213)

CURRENT GROUPS 2.5 & 2.5 AVERAGE

USED 1,2,3,4

String 14 & 15 Module Outputs for TRMM -Y outer panel (Drawing 828340-2)

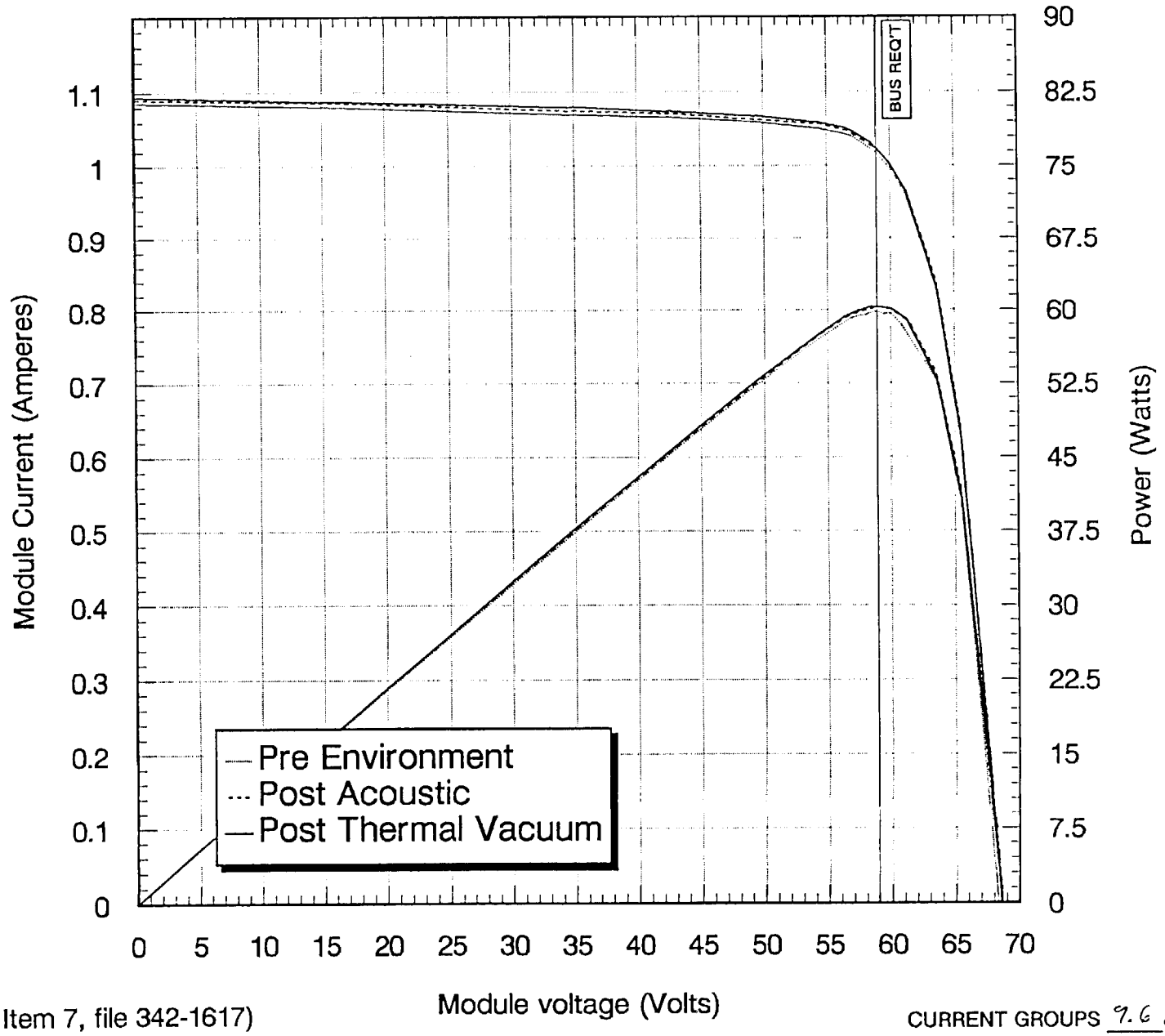


(Line Item 6, file 342-1415)

CURRENT GROUPS 4 & 4 Average

USED 1, 2, 3, 4, 5, 6, 7

String 16 & 17 Module Outputs for TRMM -Y outer panel (Drawing 828340-2)

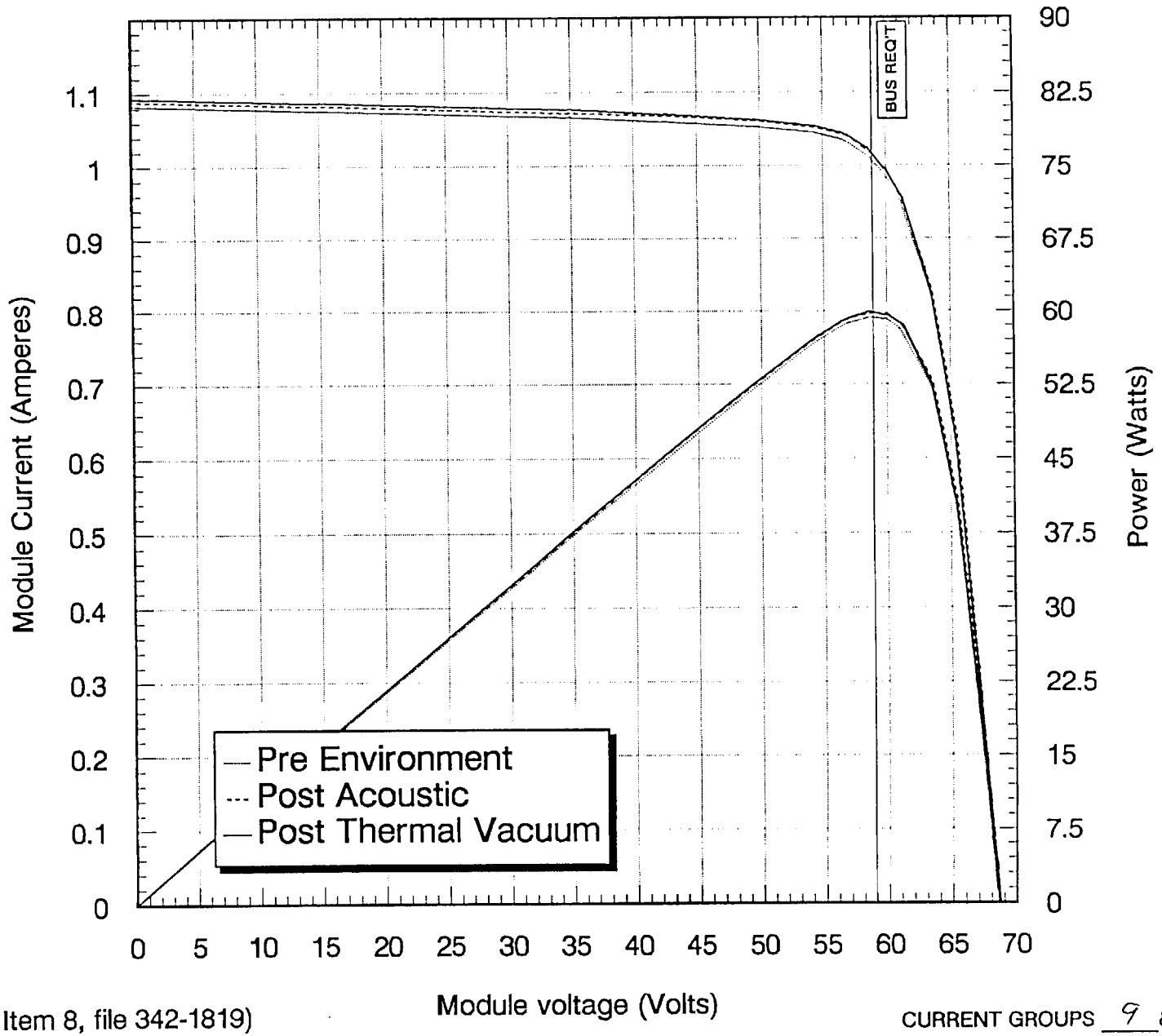


(Line Item 7, file 342-1617)

CURRENT GROUPS 9.6 & 9.6 PARTIAL

USED 8/10/11

String 18 & 19 Module Outputs for TRMM -Y outer panel (Drawing 828340-2)

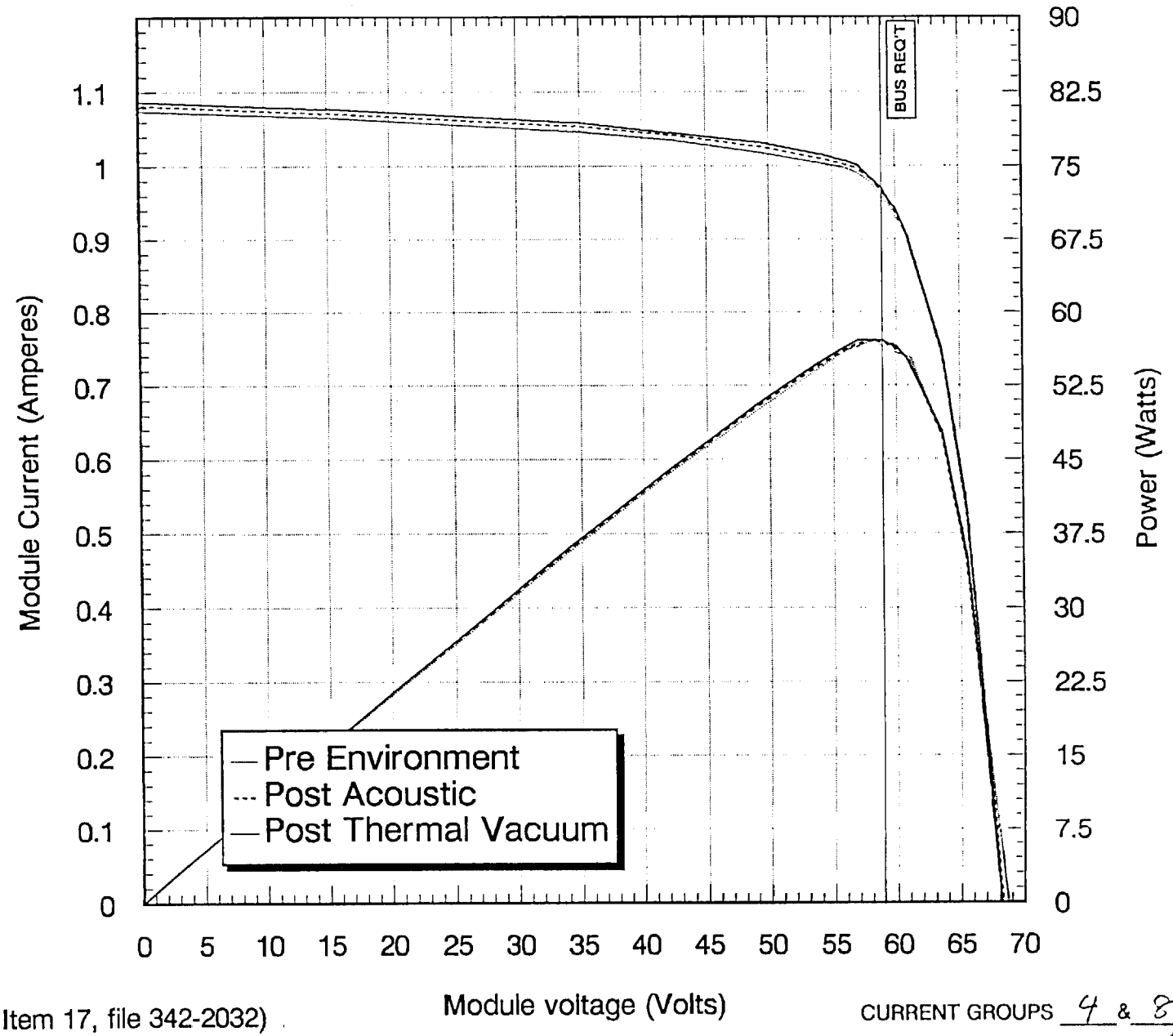


(Line Item 8, file 342-1819)

CURRENT GROUPS 9 & 9 Average

used 8,9,10

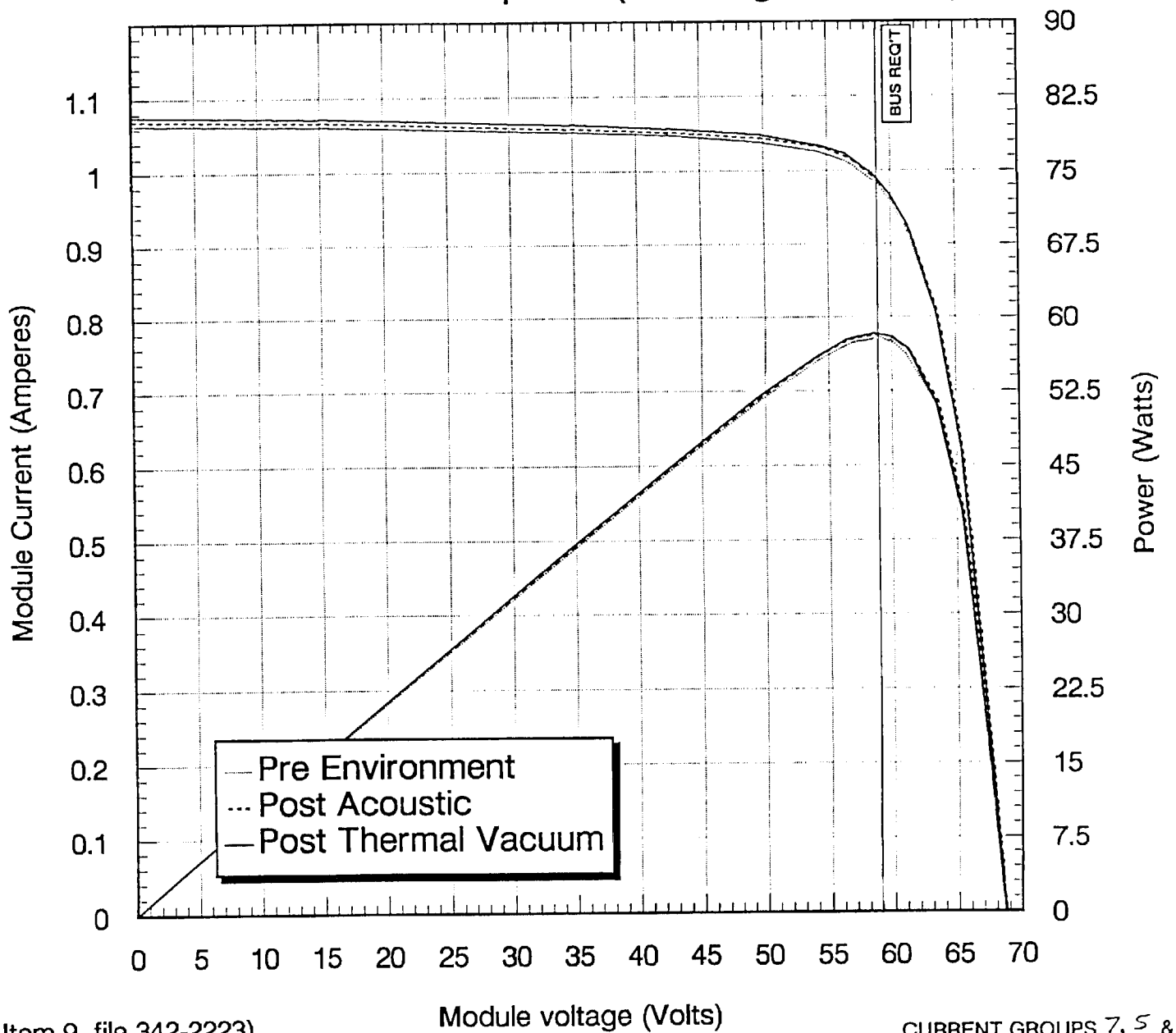
String 20 & 32 Module Outputs for TRMM -Y outer panel (Drawing 828340-2)



(Line Item 17, file 342-2032)

CURRENT GROUPS 4 & 8 → AVERAGE

String 22 & 23 Module Outputs for TRMM -Y outer panel (Drawing 828340-2)

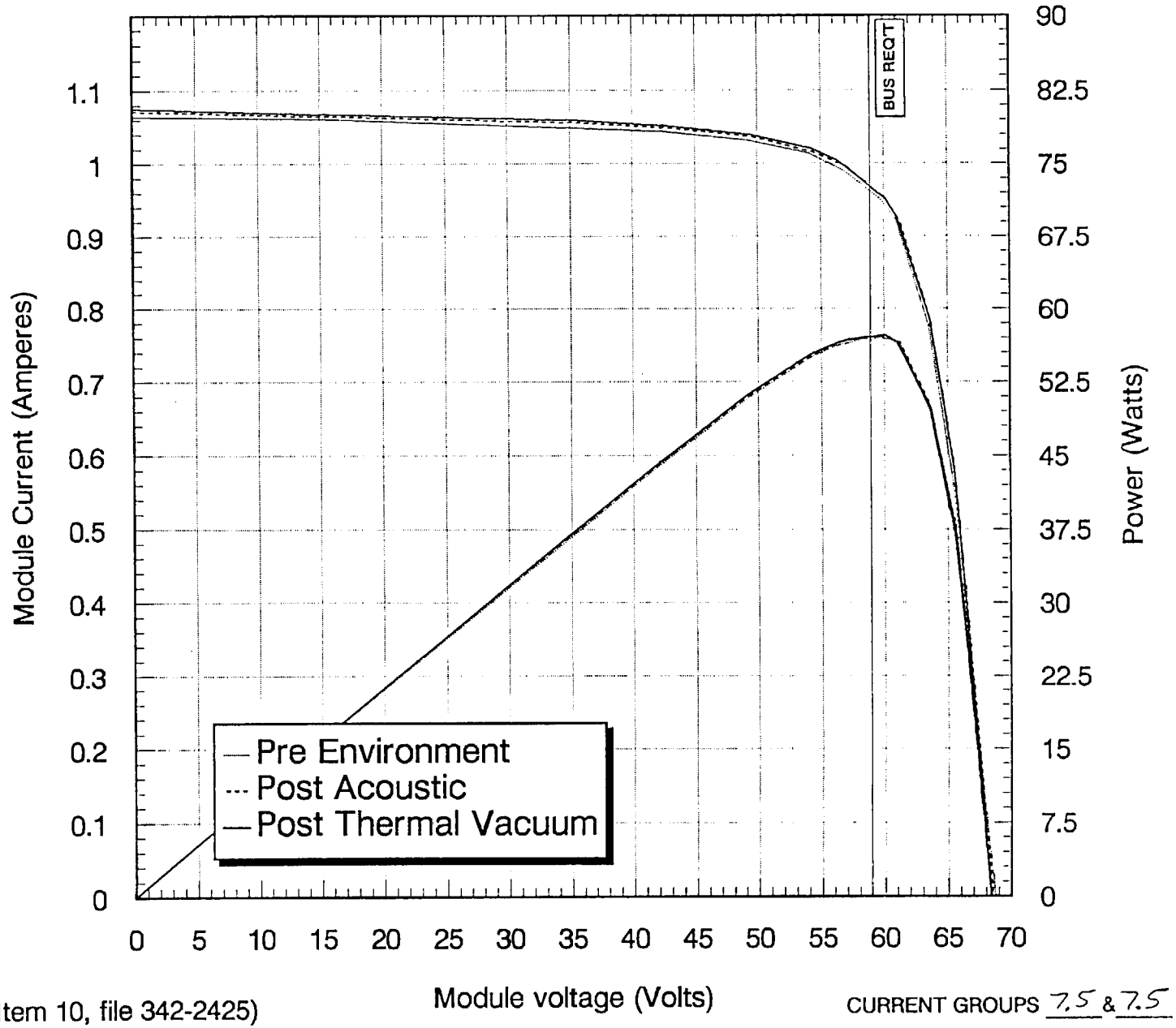


(Line Item 9, file 342-2223)

CURRENT GROUPS 7.5 & 7.5 AVG

USC 6789

String 24 & 25 Module Outputs for TRMM -Y outer panel (Drawing 828340-2)

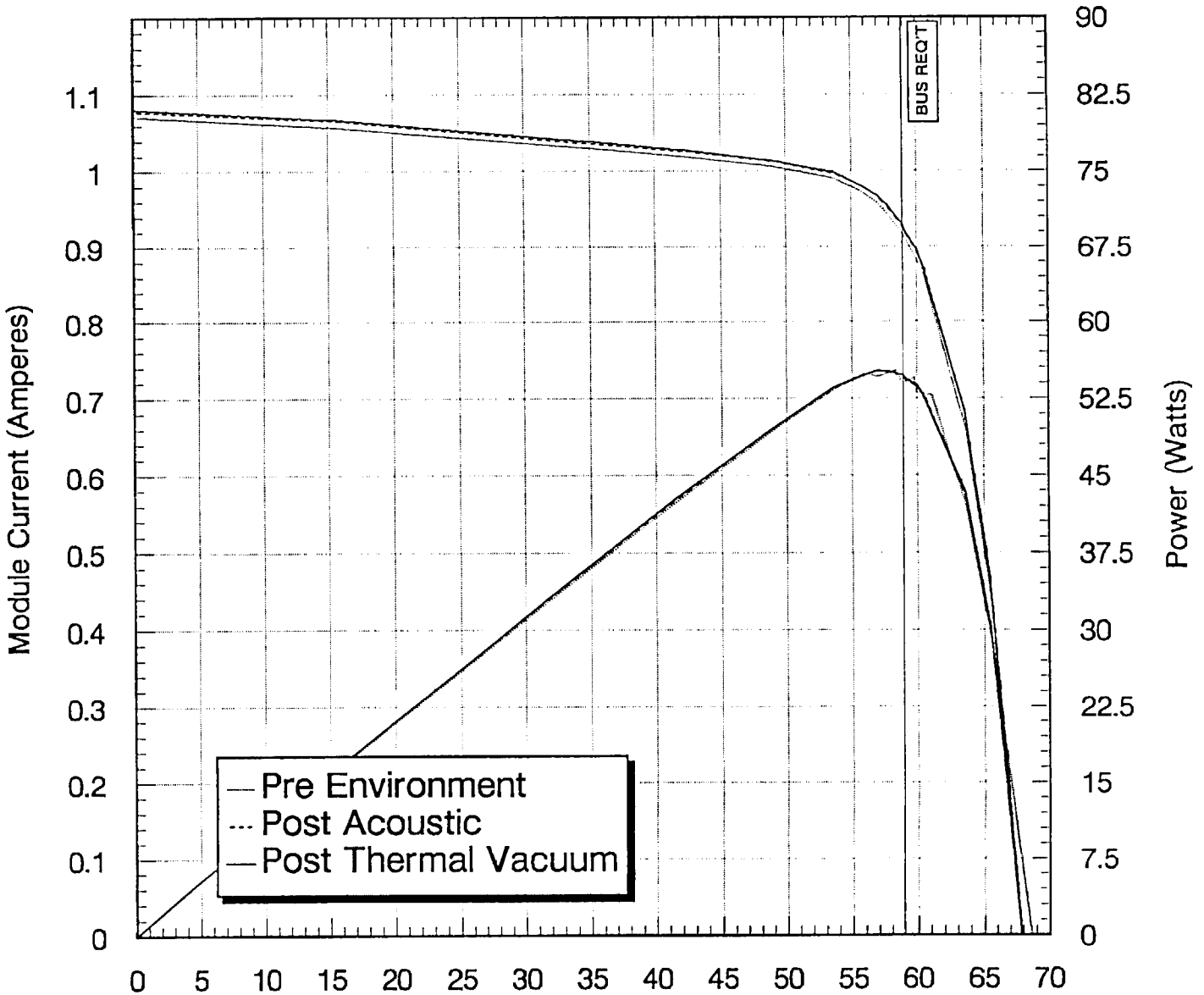


(Line Item 10, file 342-2425)

CURRENT GROUPS 7.5 & 7.5 AVERAGE

USD 1789

String 26 & 27 Module Outputs for TRMM -Y outer panel (Drawing 828340-2)

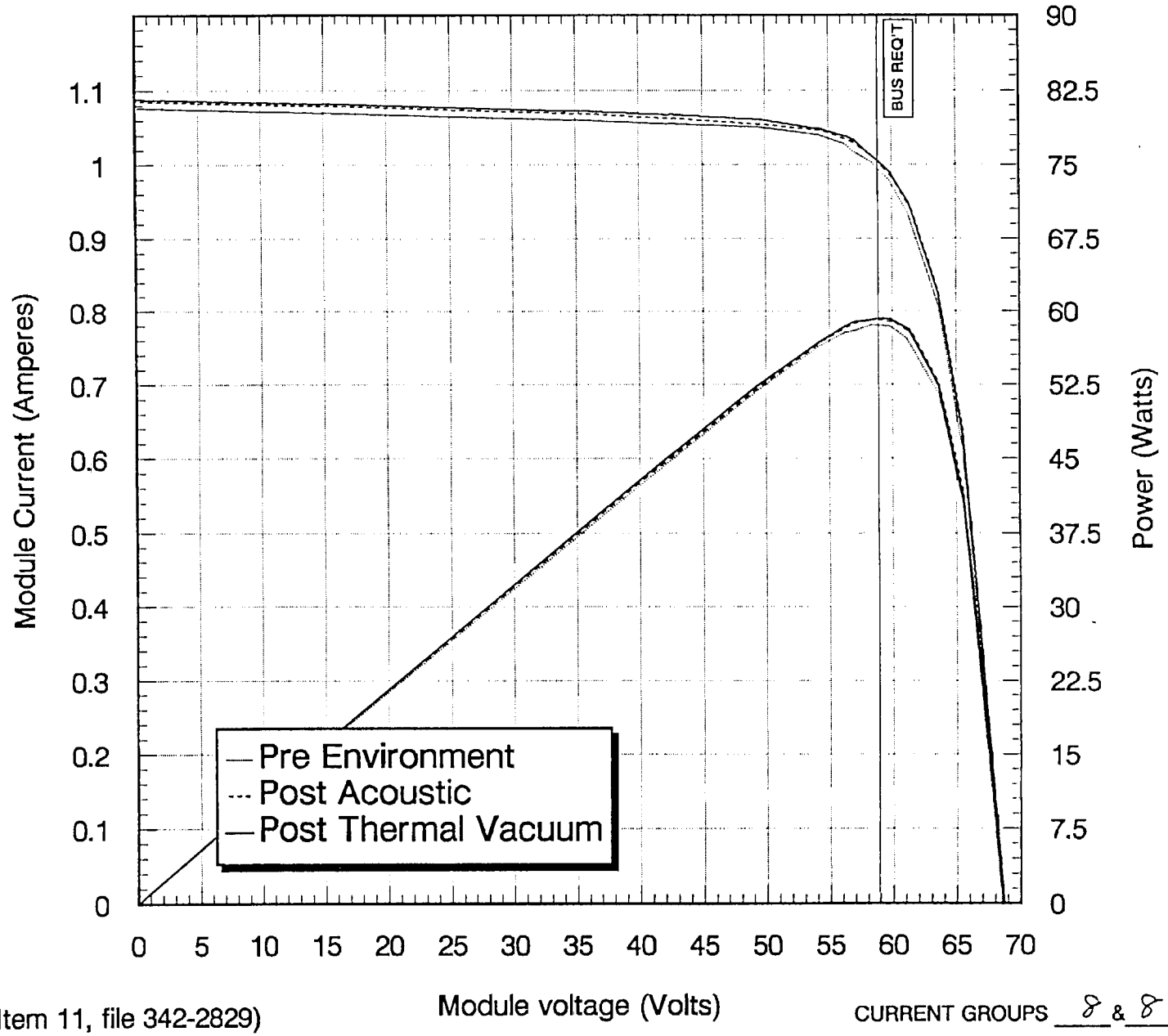


(Line Item 15, file 342-2627)

CURRENT GROUPS AVERAGE .3 & .8

USED 0,1

String 28 & 29 Module Outputs for TRMM -Y outer panel (Drawing 828340-2)

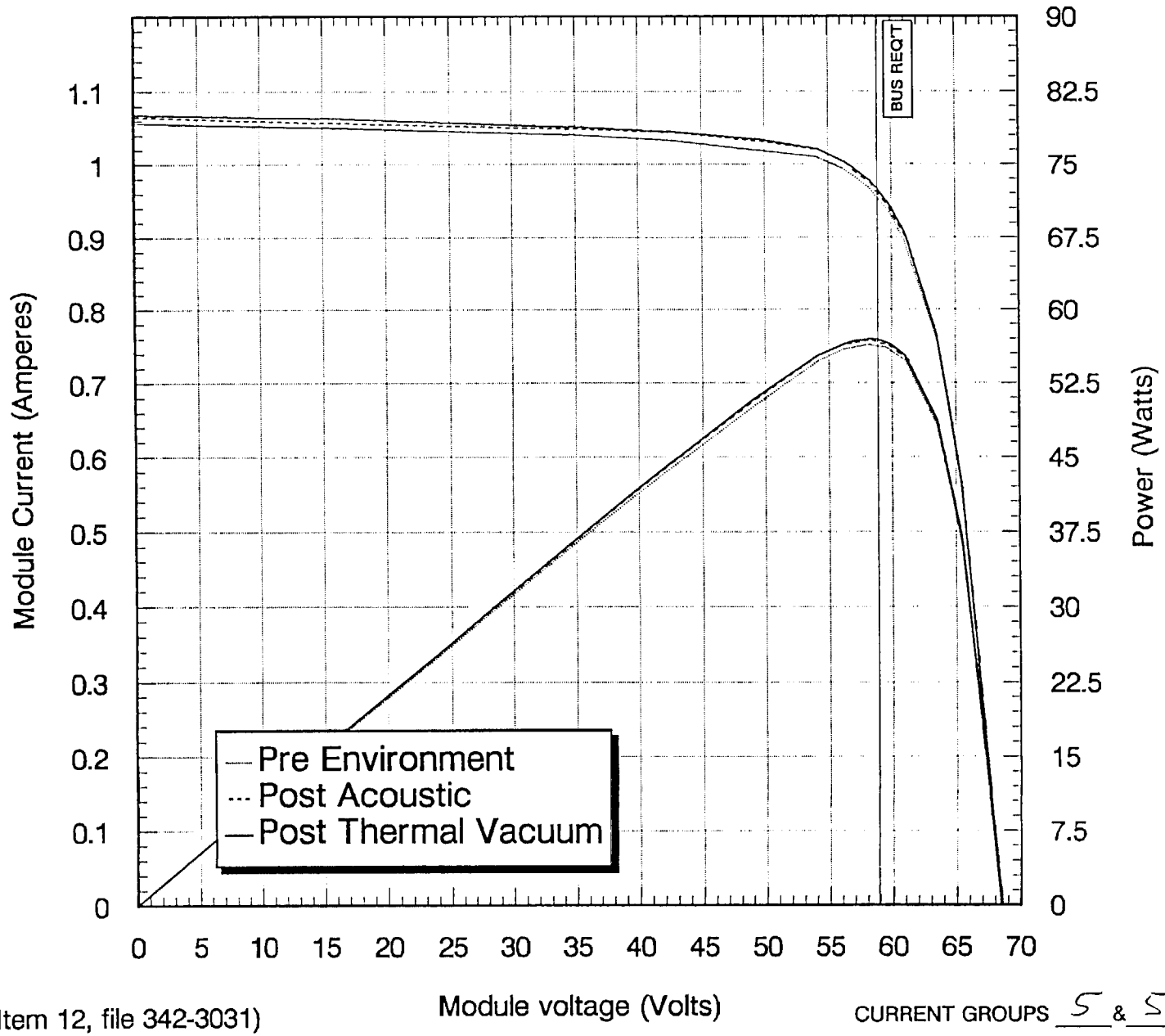


(Line Item 11, file 342-2829)

CURRENT GROUPS 8 & 8 AVERAGE

USED 6, 7, 8, 9

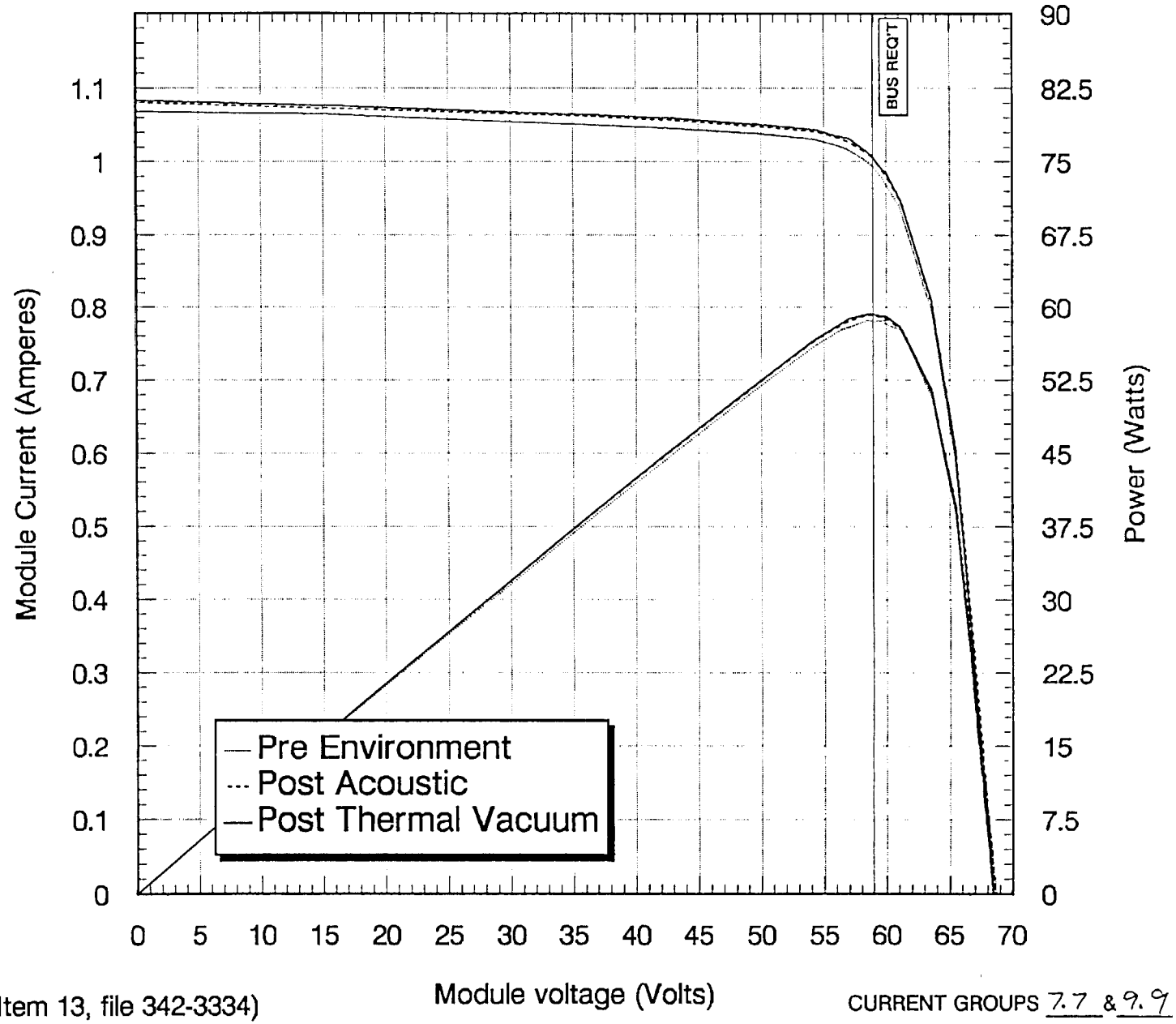
String 30 & 31 Module Outputs for TRMM -Y outer panel (Drawing 828340-2)



(Line Item 12, file 342-3031)

CURRENT GROUPS 5 & 5 average used 5, 6, 4

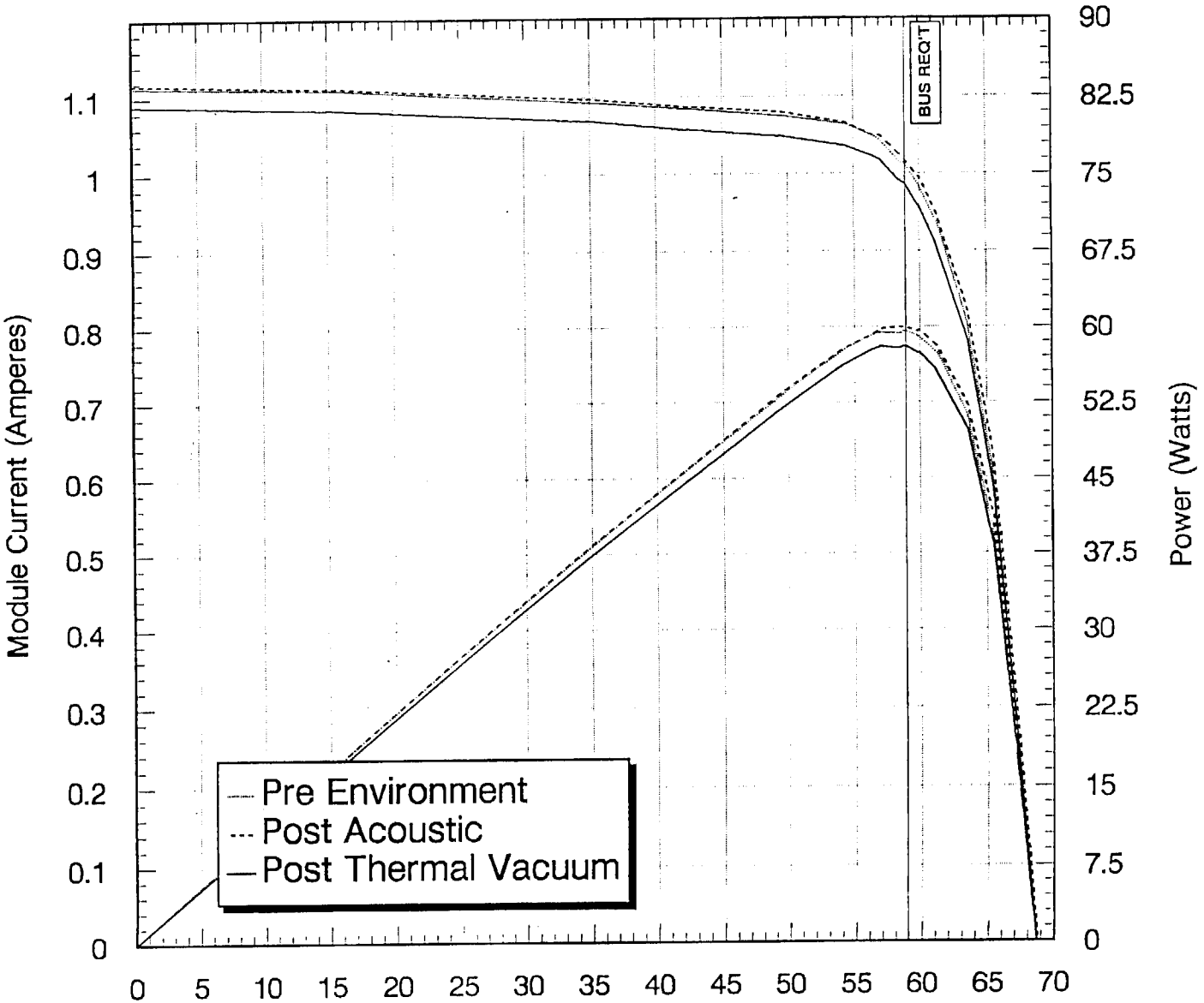
String 33 & 34 Module Outputs for TRMM -Y outer panel (Drawing 828340-2)



(Line Item 13, file 342-3334)

CURRENT GROUPS 7.7 & 9.9 used 7, 8, 9, 11, 10

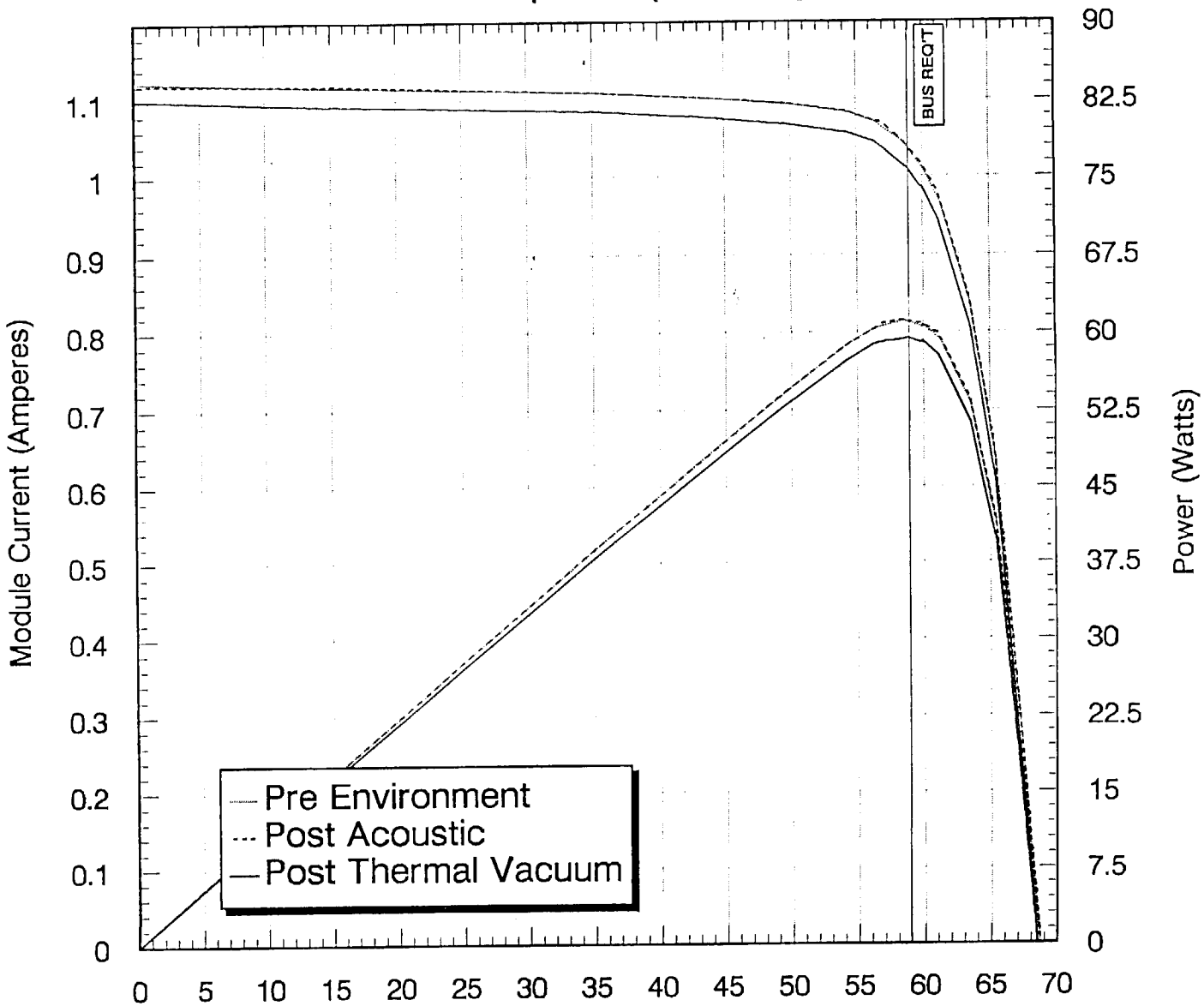
String 1 & 2 Module Outputs for TRMM +Y outer panel (Drawing 828340-1)



(Line Item 1, file 340-0102)

CURRENT GROUPS 10 & 12

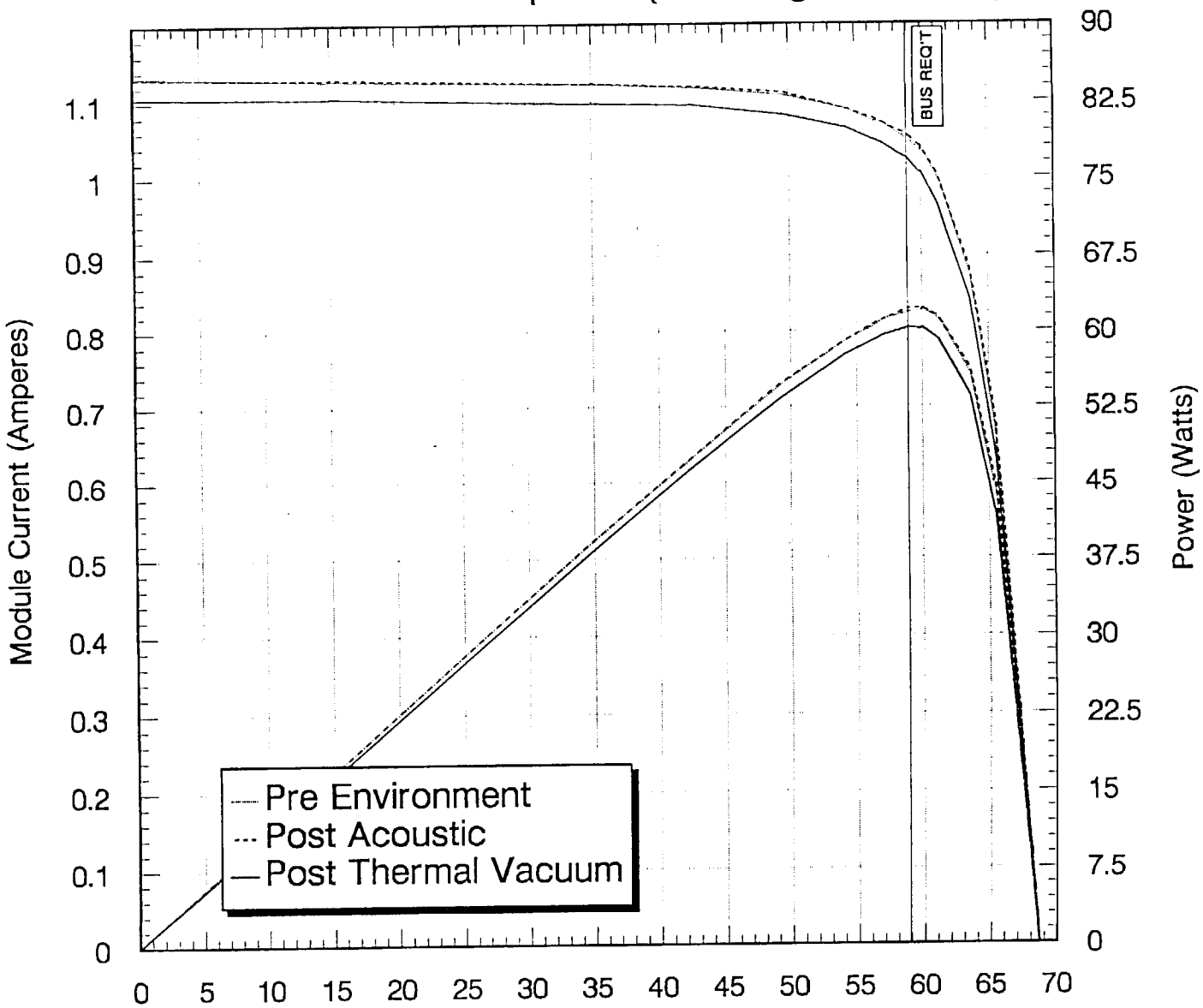
String 3 & 4 Module Outputs for TRMM +Y outer panel (Drawing 828340-1)



(Line Item 14, file 340-0304)

CURRENT GROUPS 11 & 11

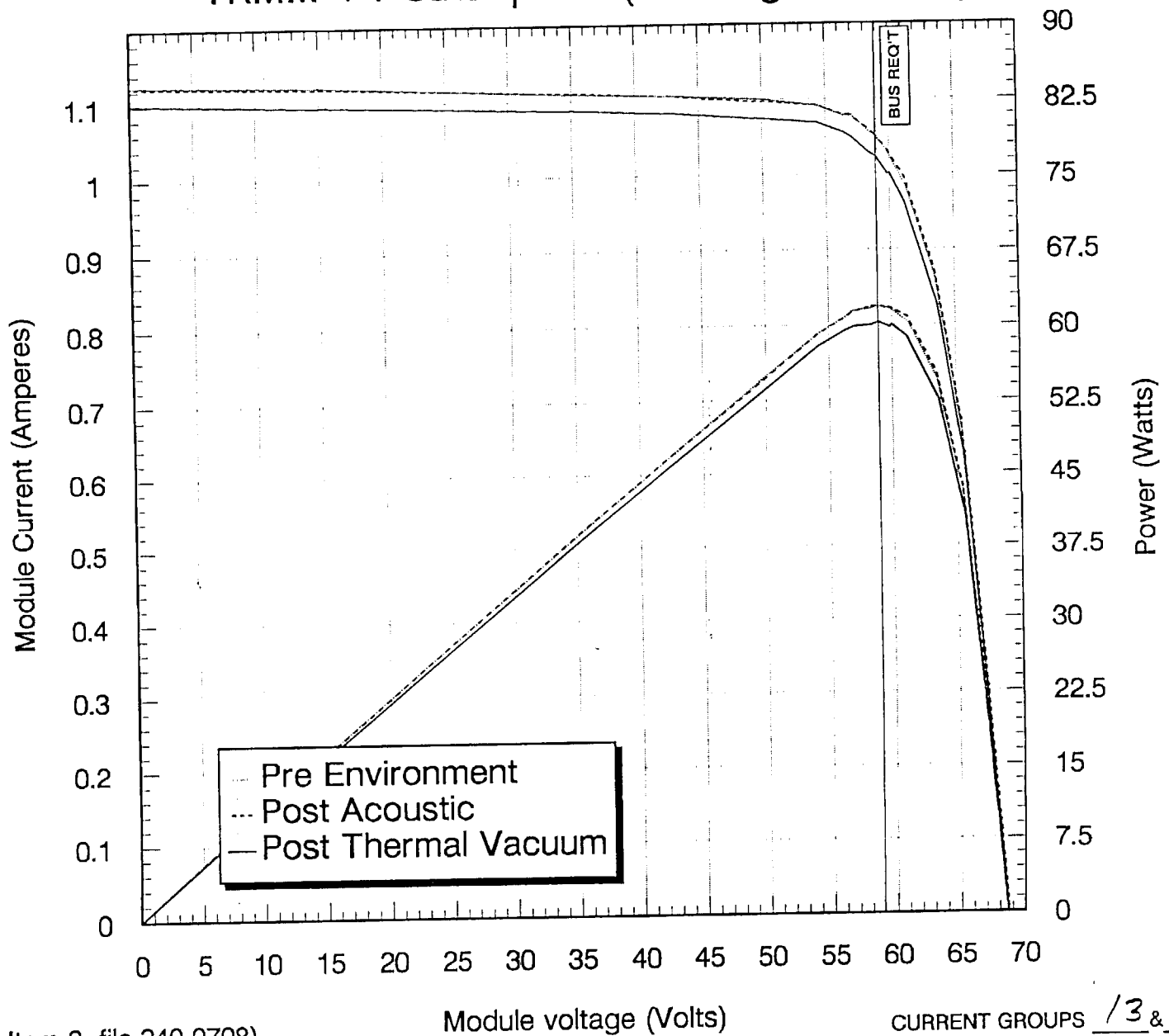
String 5 & 6 Module Outputs for TRMM +Y outer panel (Drawing 828340-1)



(Line Item 2, file 340-0506)

CURRENT GROUPS 13 & 13

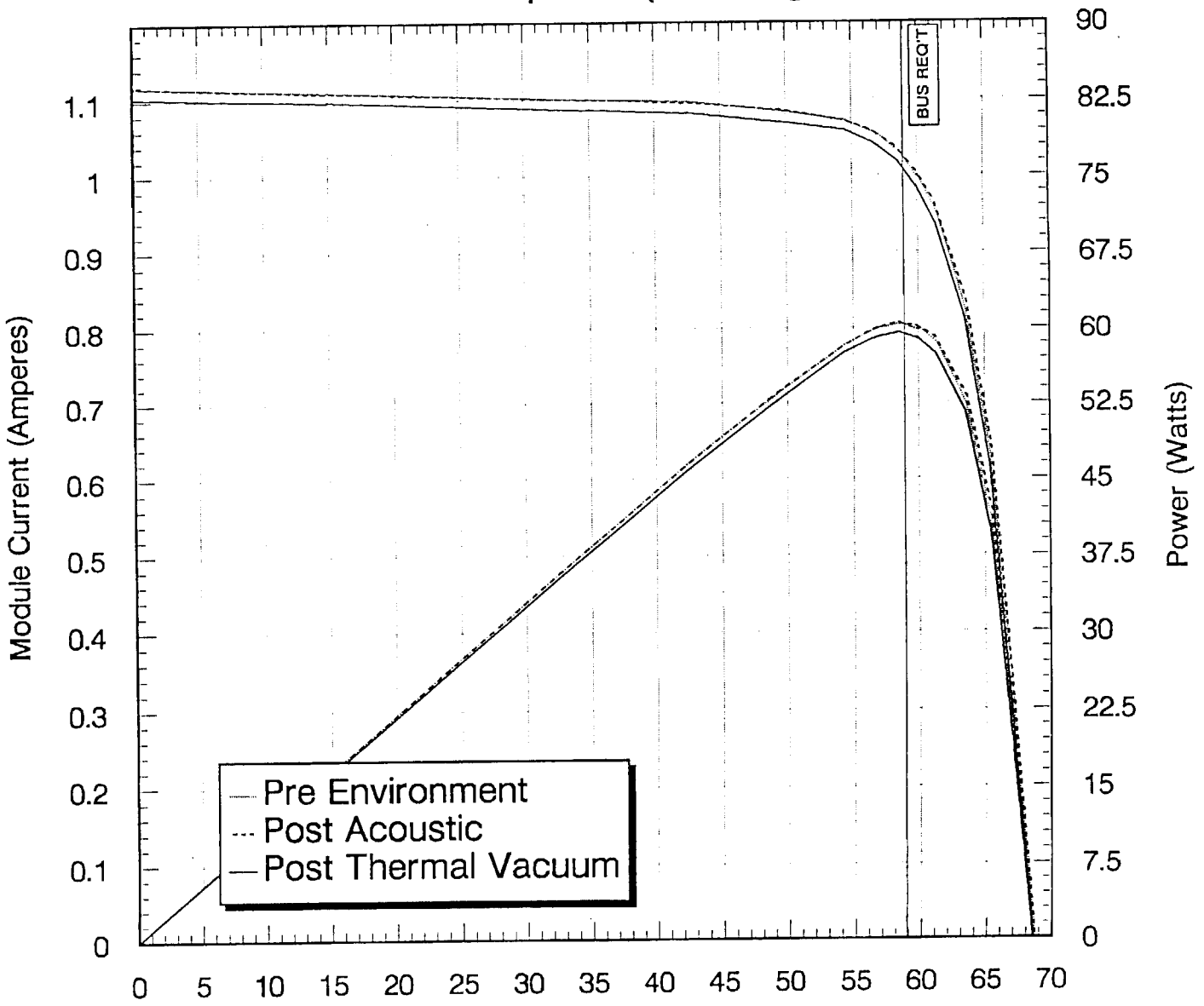
String 7 & 8 Module Outputs for TRMM +Y outer panel (Drawing 828340-1)



(Line Item 3, file 340-0708)

CURRENT GROUPS 13 & 11

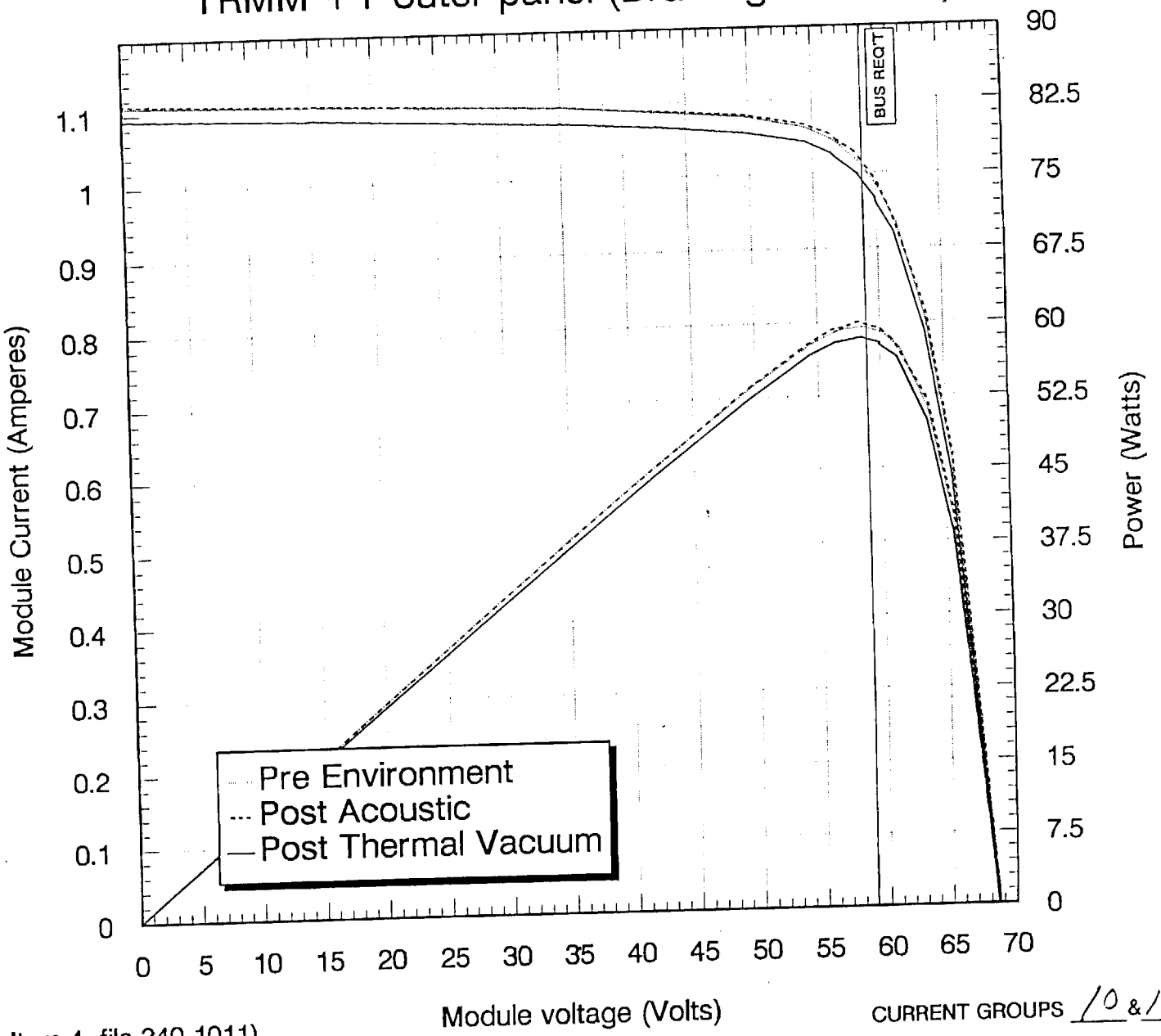
String 9 & 21 Module Outputs for TRMM +Y outer panel (Drawing 828340-1)



(Line Item 16, file 340-0921)

CURRENT GROUPS 10 & 10

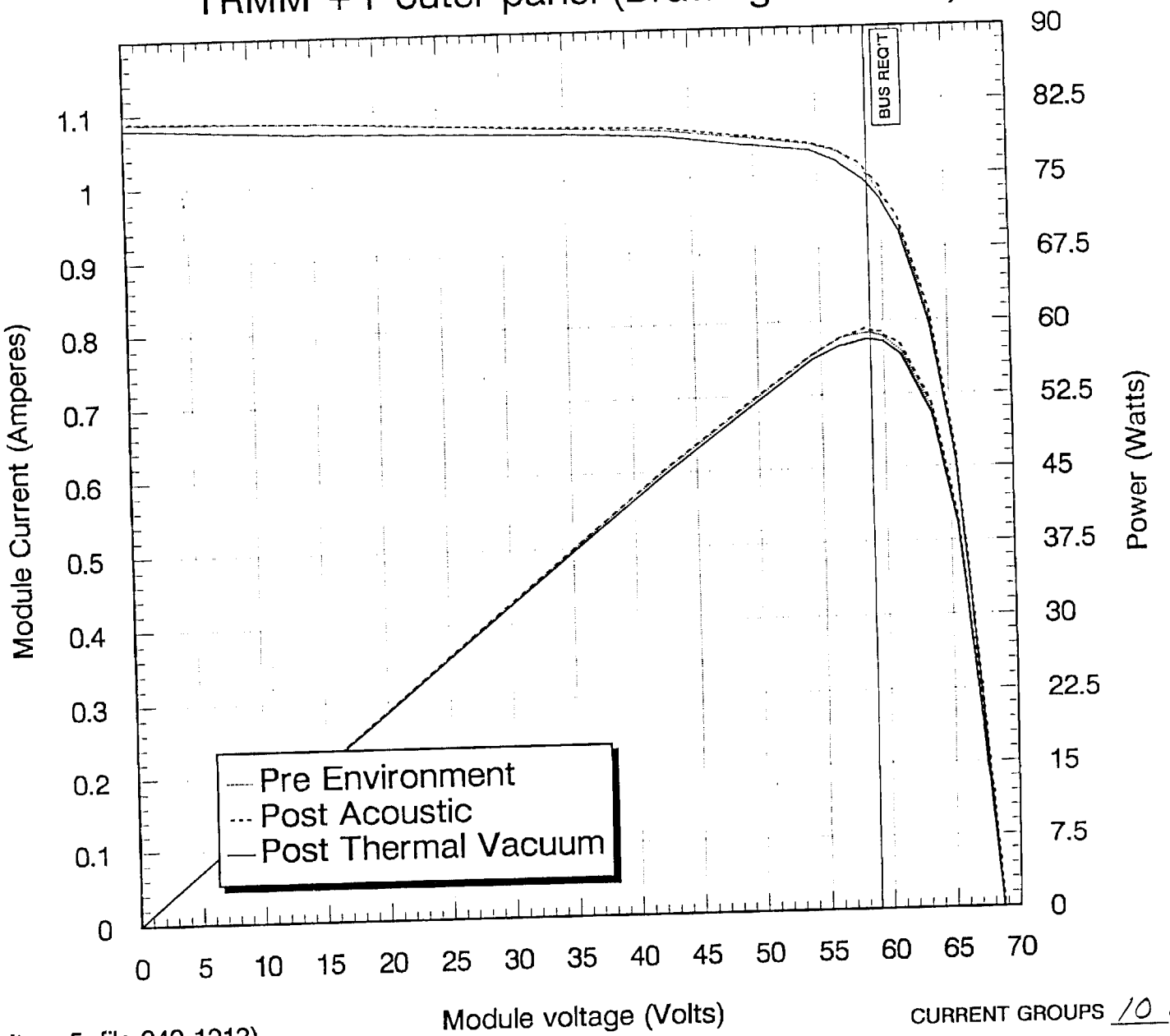
String 10 & 11 Module Outputs for TRMM +Y outer panel (Drawing 828340-1)



CURRENT GROUPS 10 & 10

(Line Item 4, file 340-1011)

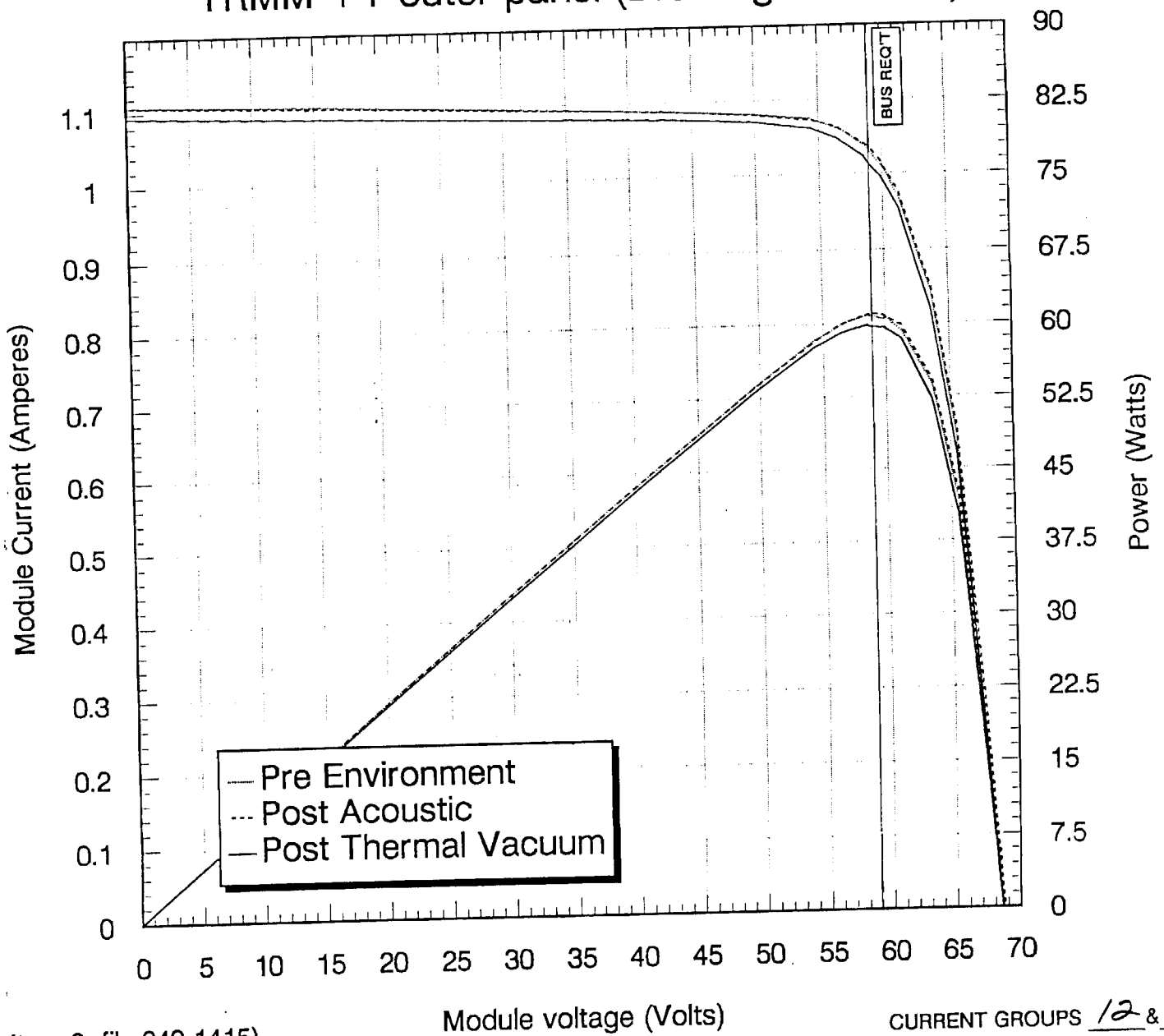
String 12 & 13 Module Outputs for TRMM +Y outer panel (Drawing 828340-1)



(Line Item 5, file 340-1213)

CURRENT GROUPS 10 & 10

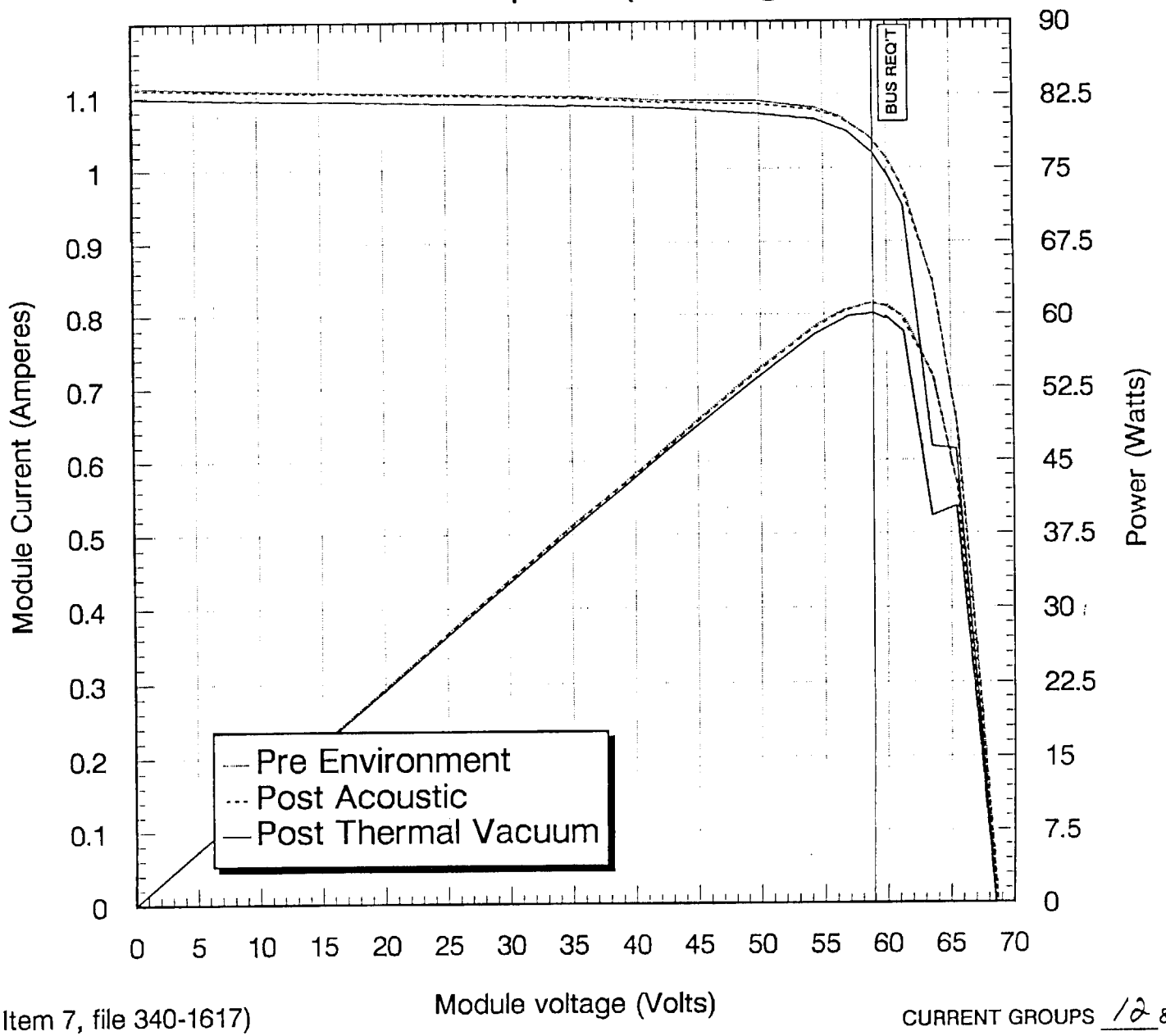
String 14 & 15 Module Outputs for TRMM +Y outer panel (Drawing 828340-1)



(Line Item 6, file 340-1415)

CURRENT GROUPS 12 & 12

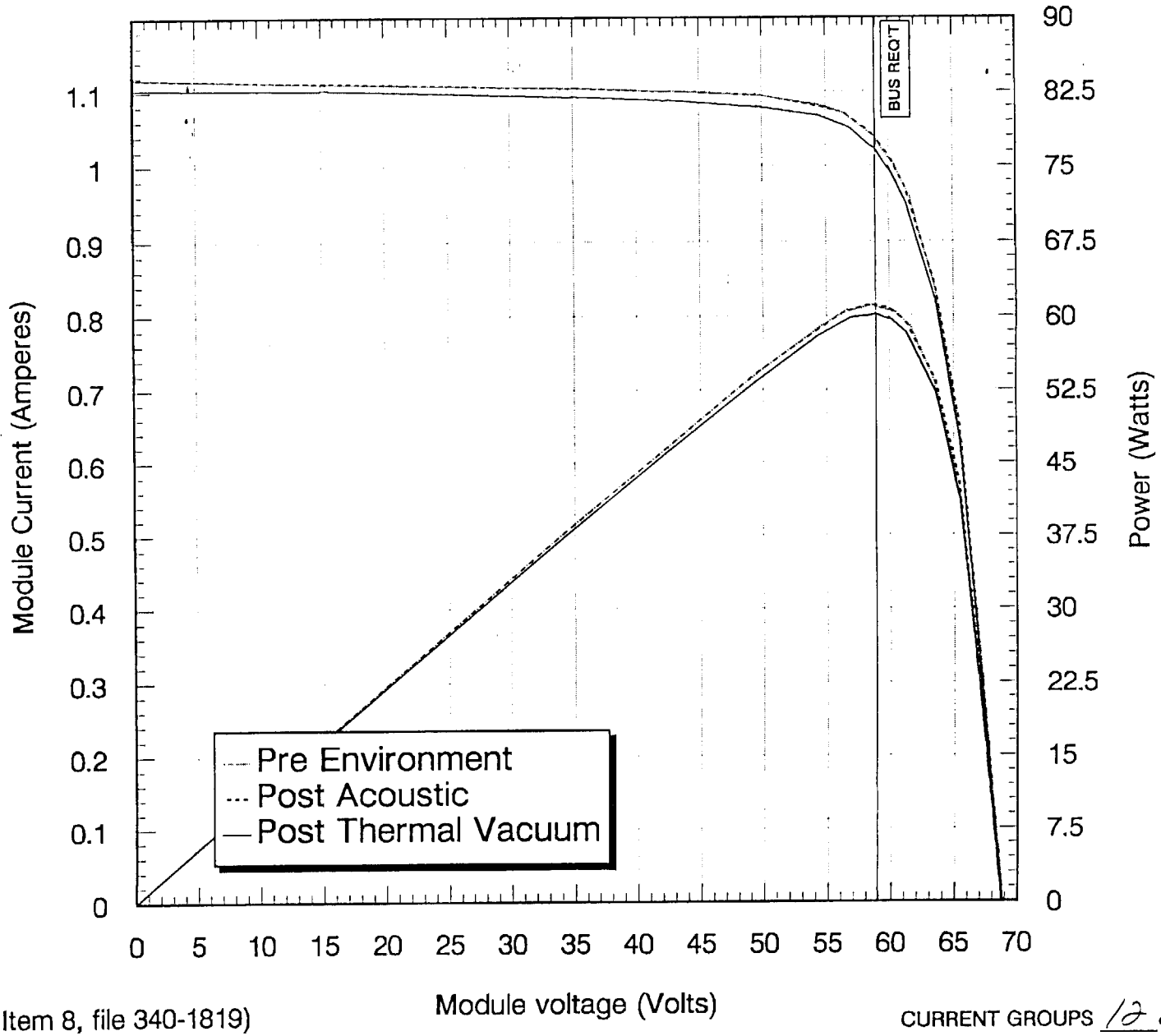
String 16 & 17 Module Outputs for TRMM +Y outer panel (Drawing 828340-1)



(Line Item 7, file 340-1617)

CURRENT GROUPS 12 & 12

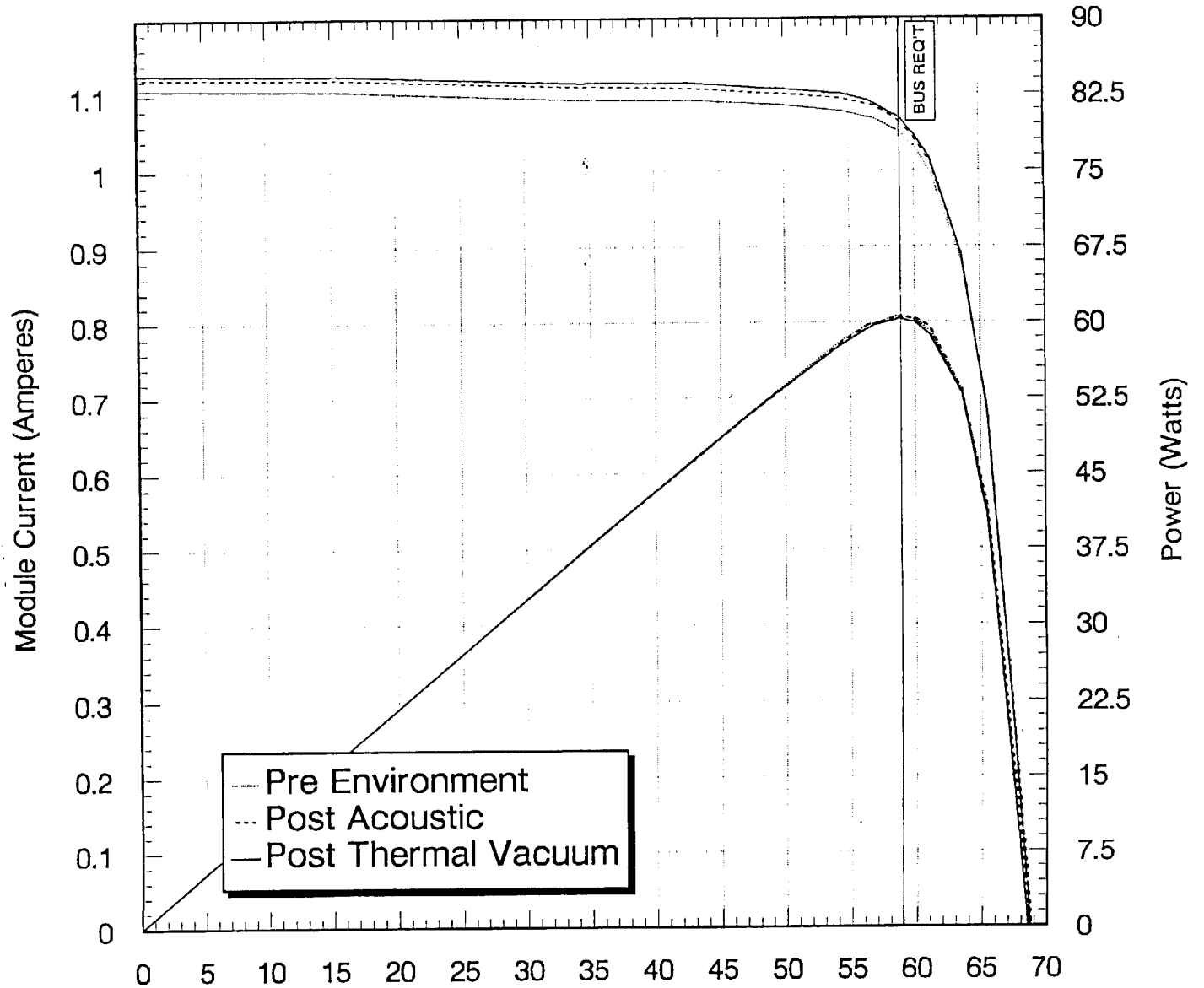
String 18 & 19 Module Outputs for TRMM +Y outer panel (Drawing 828340-1)



(Line Item 8, file 340-1819)

CURRENT GROUPS 12 & 12

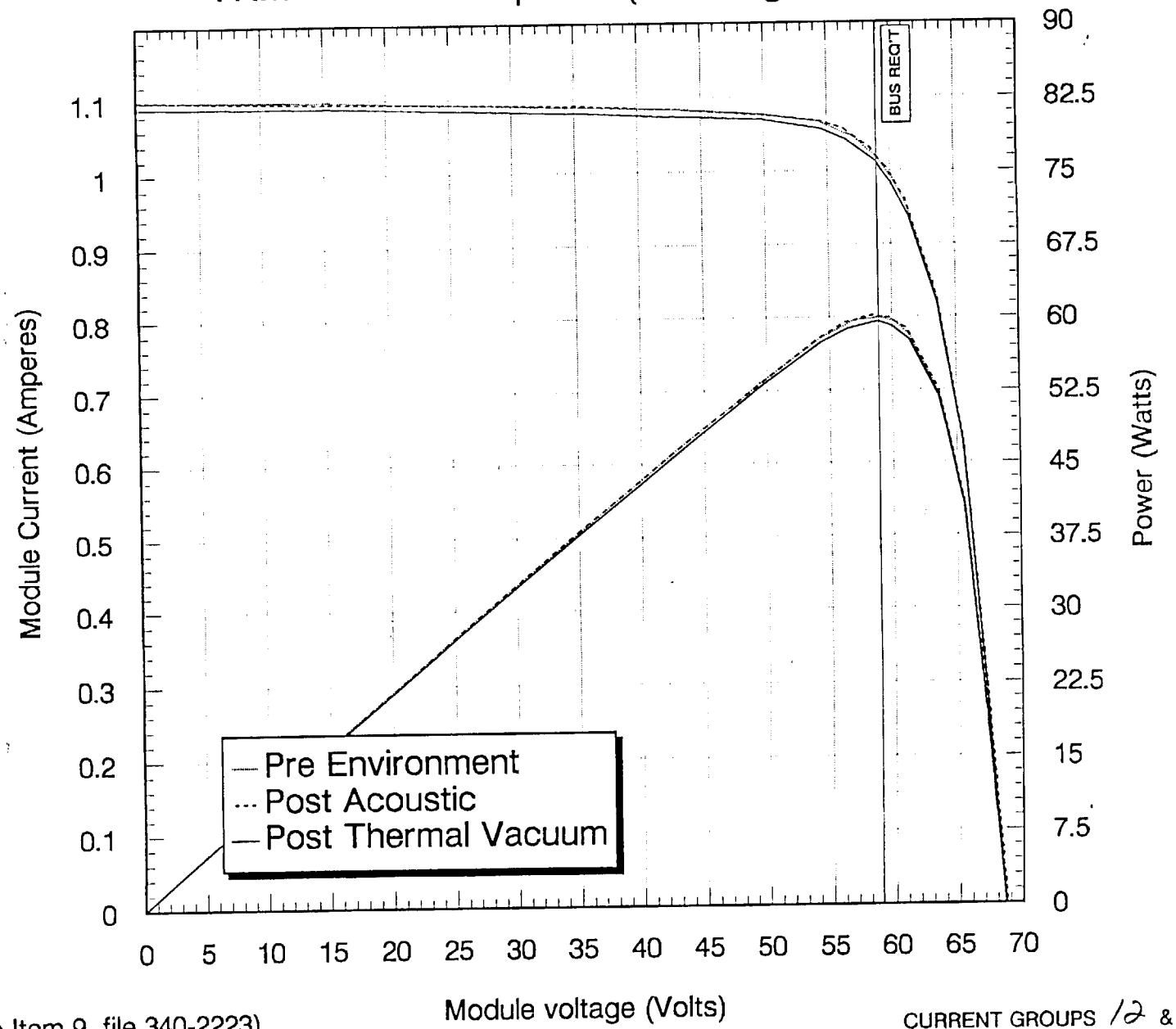
String 20 & 32 Module Outputs for TRMM +Y outer panel (Drawing 828340-1)



(Line Item 17, file 340-2032)

CURRENT GROUPS // & //

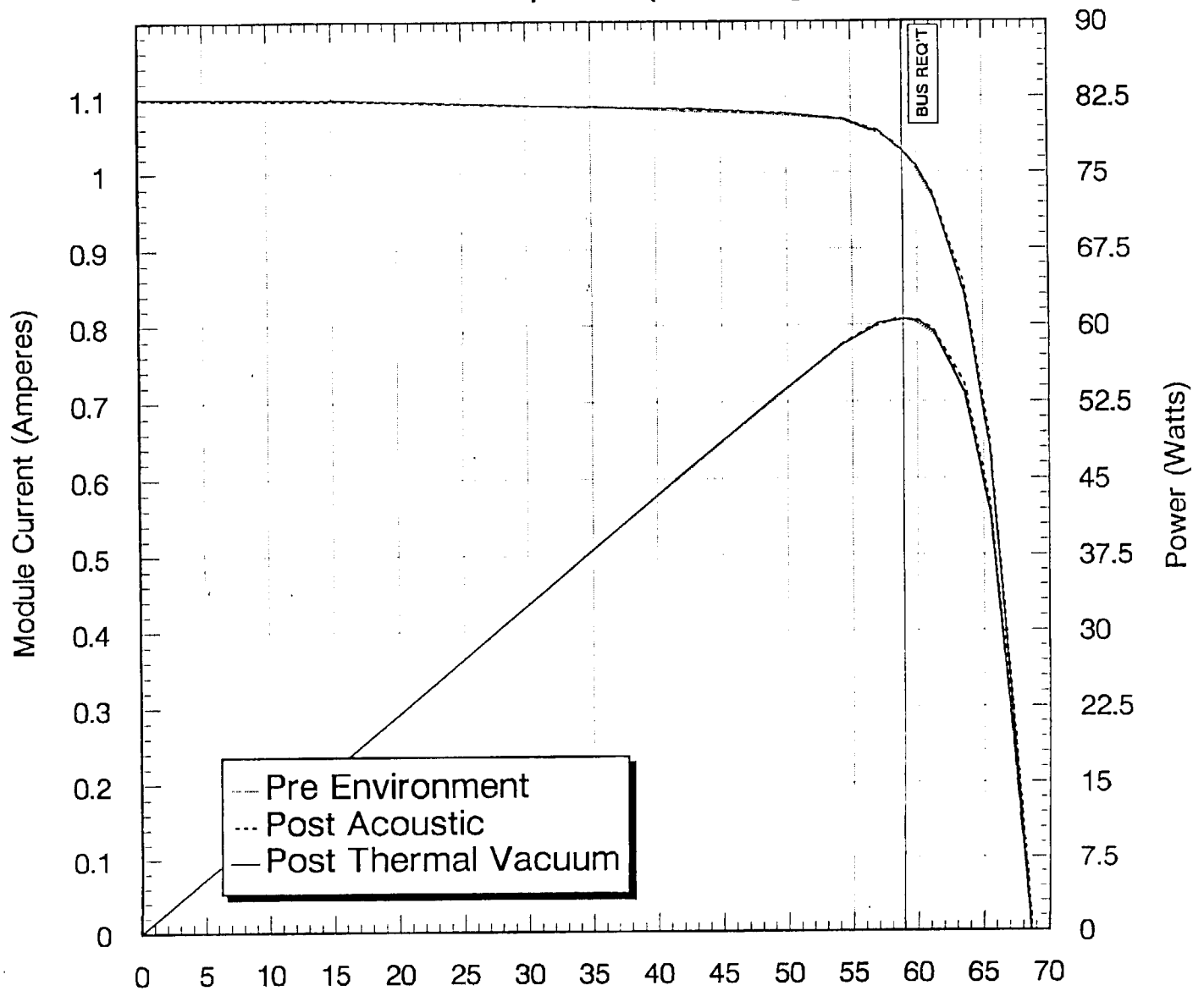
String 22 & 23 Module Outputs for TRMM +Y outer panel (Drawing 828340-1)



(Line Item 9, file 340-2223)

CURRENT GROUPS 12 & 12

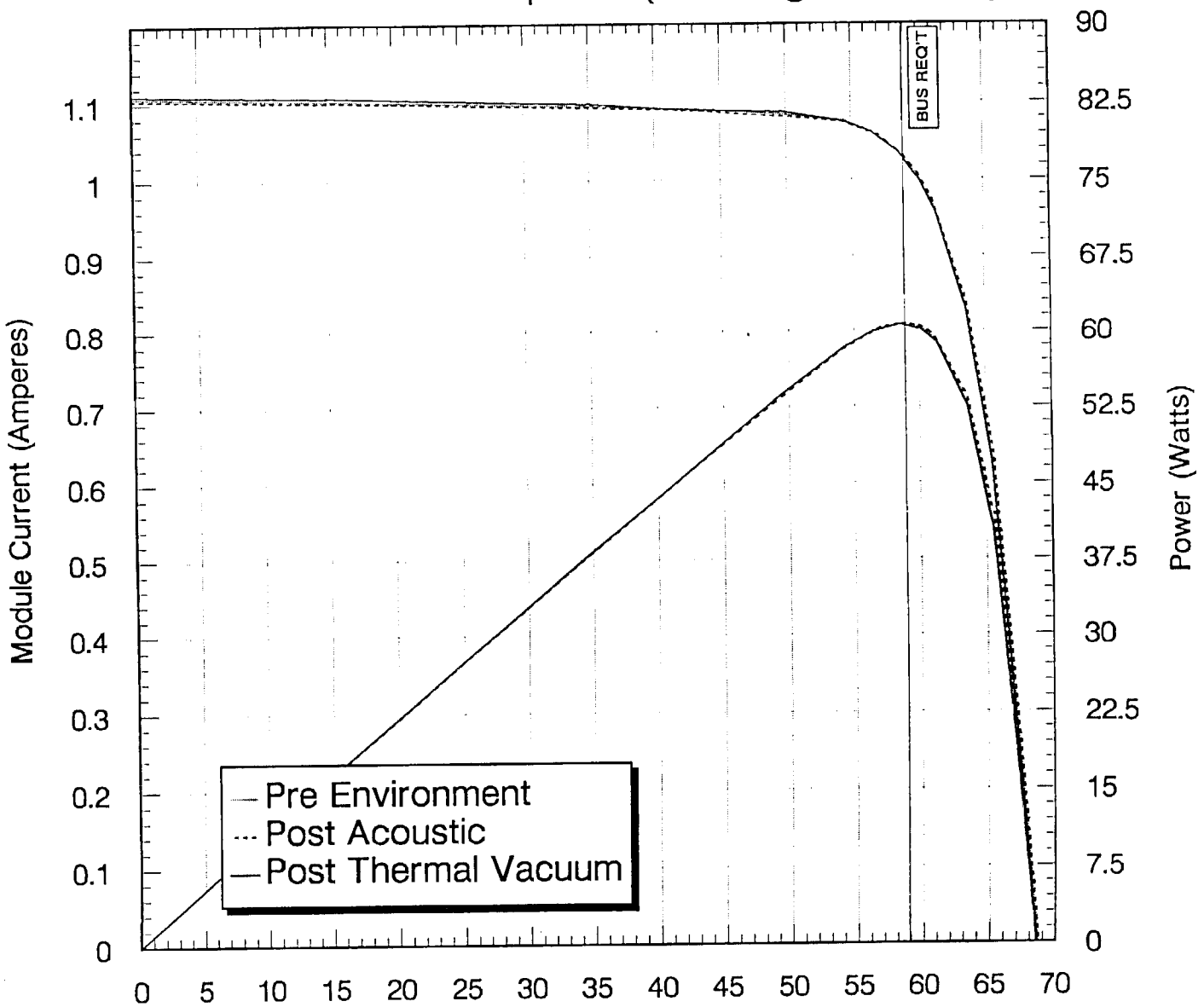
String 24 & 25 Module Outputs for TRMM +Y outer panel (Drawing 828340-1)



(Line Item 10, file 340-2425)

CURRENT GROUPS 12 & 12

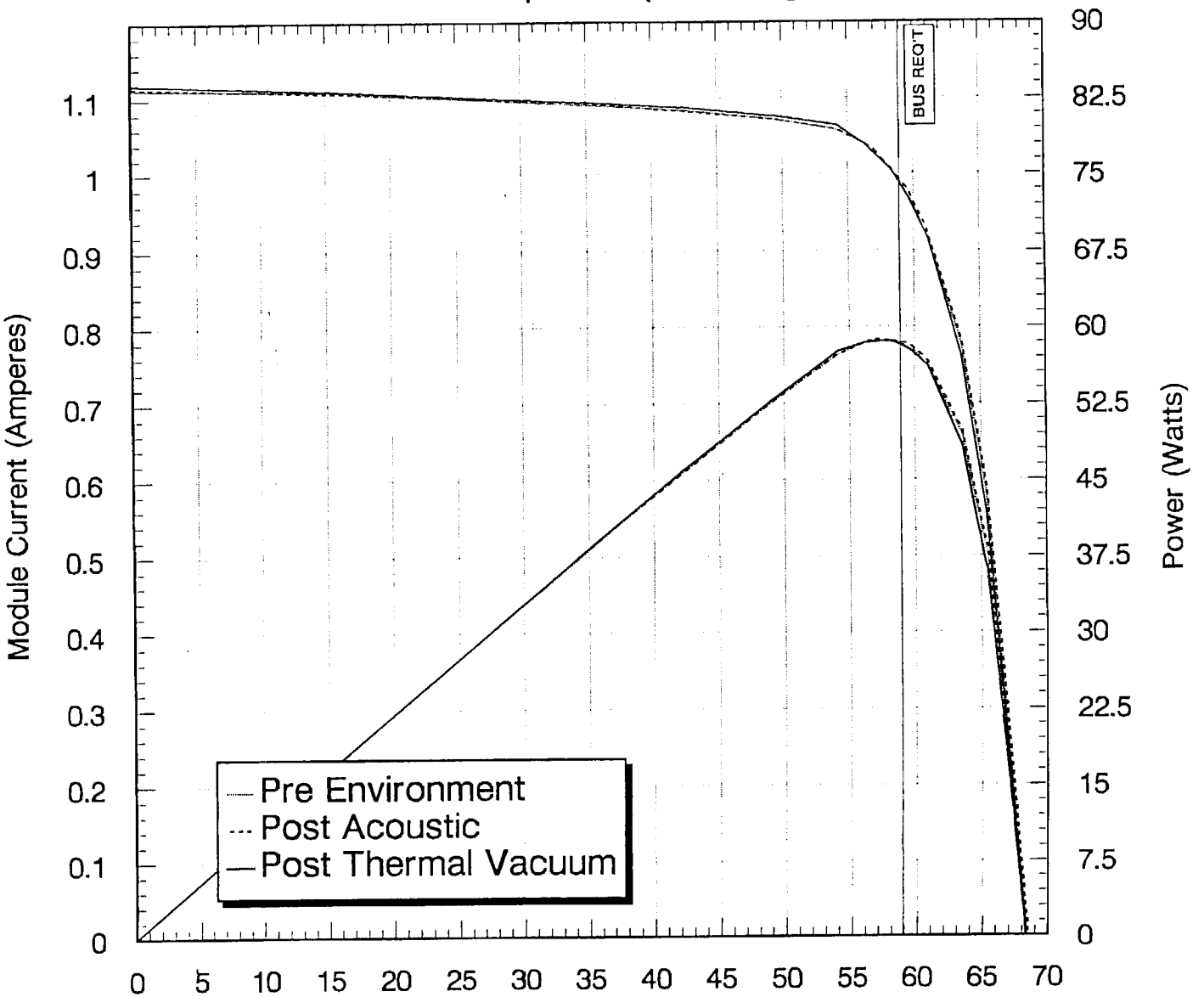
String 26 & 27 Module Outputs for TRMM +Y outer panel (Drawing 828340-1)



(Line Item 15, file 340-2627)

CURRENT GROUPS II & II

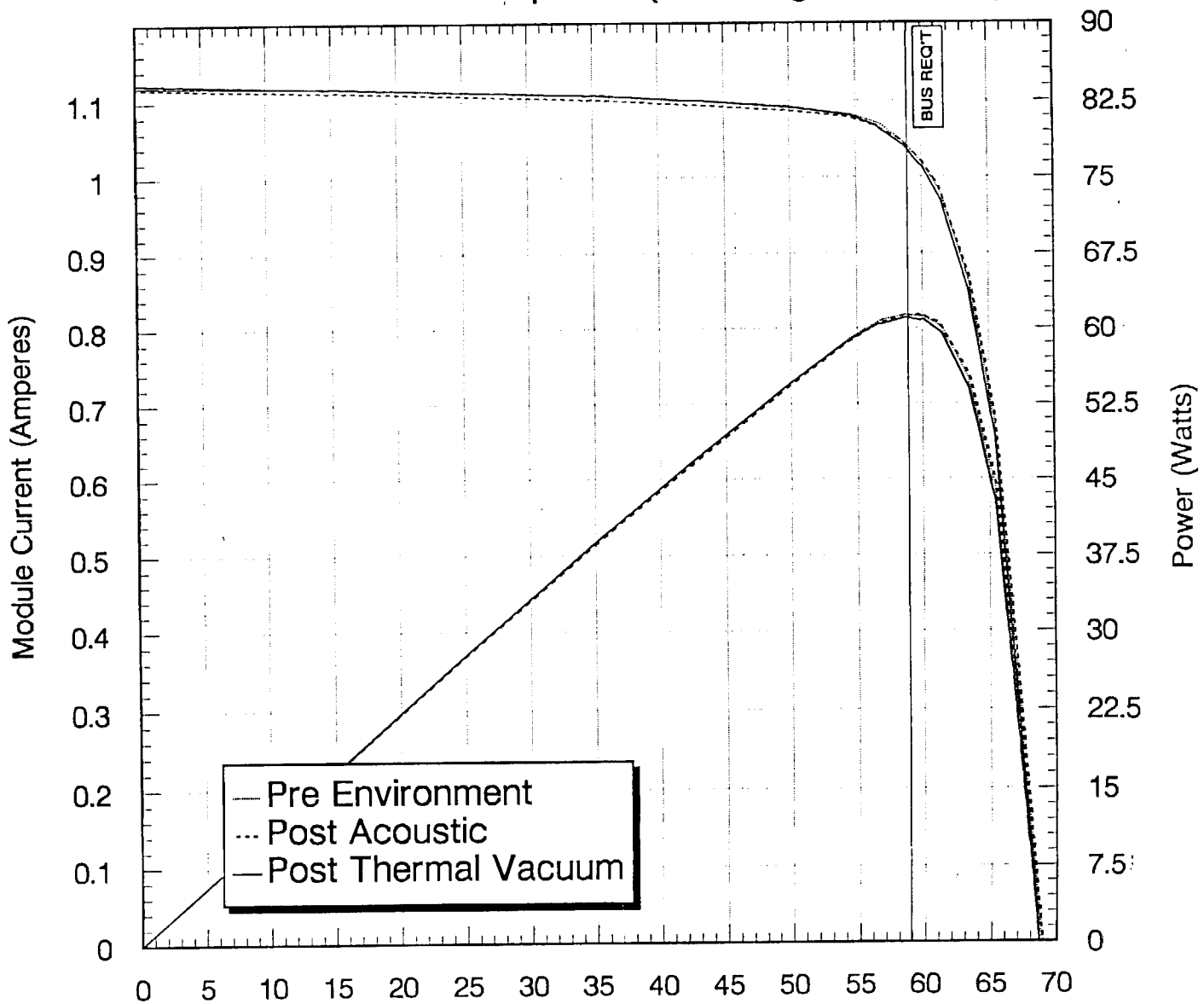
String 28 & 29 Module Outputs for TRMM +Y outer panel (Drawing 828340-1)



(Line Item 11, file 340-2829)

CURRENT GROUPS 8 & 8

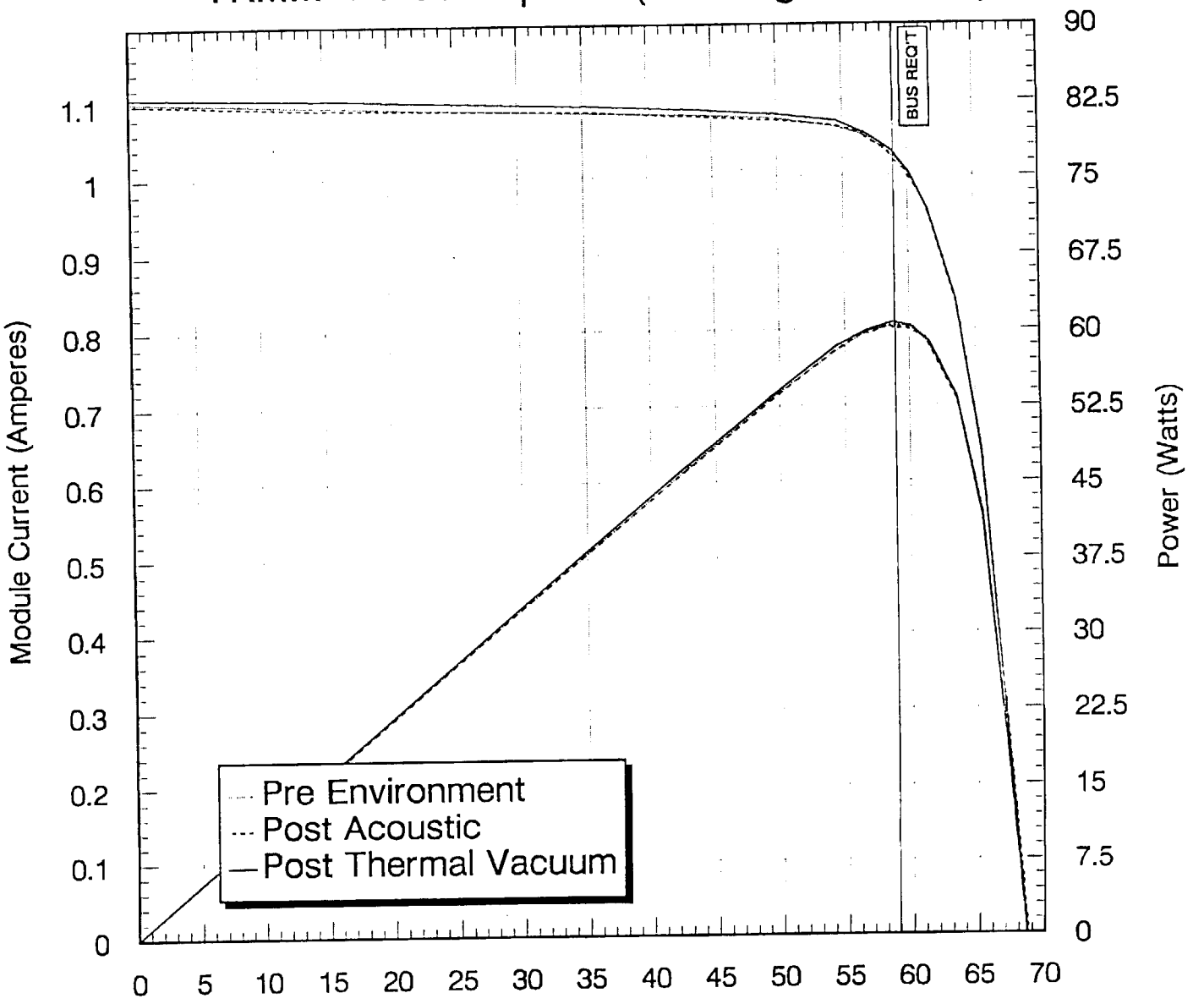
String 30 & 31 Module Outputs for TRMM +Y outer panel (Drawing 828340-1)



(Line Item 12, file 340-3031)

CURRENT GROUPS // & //

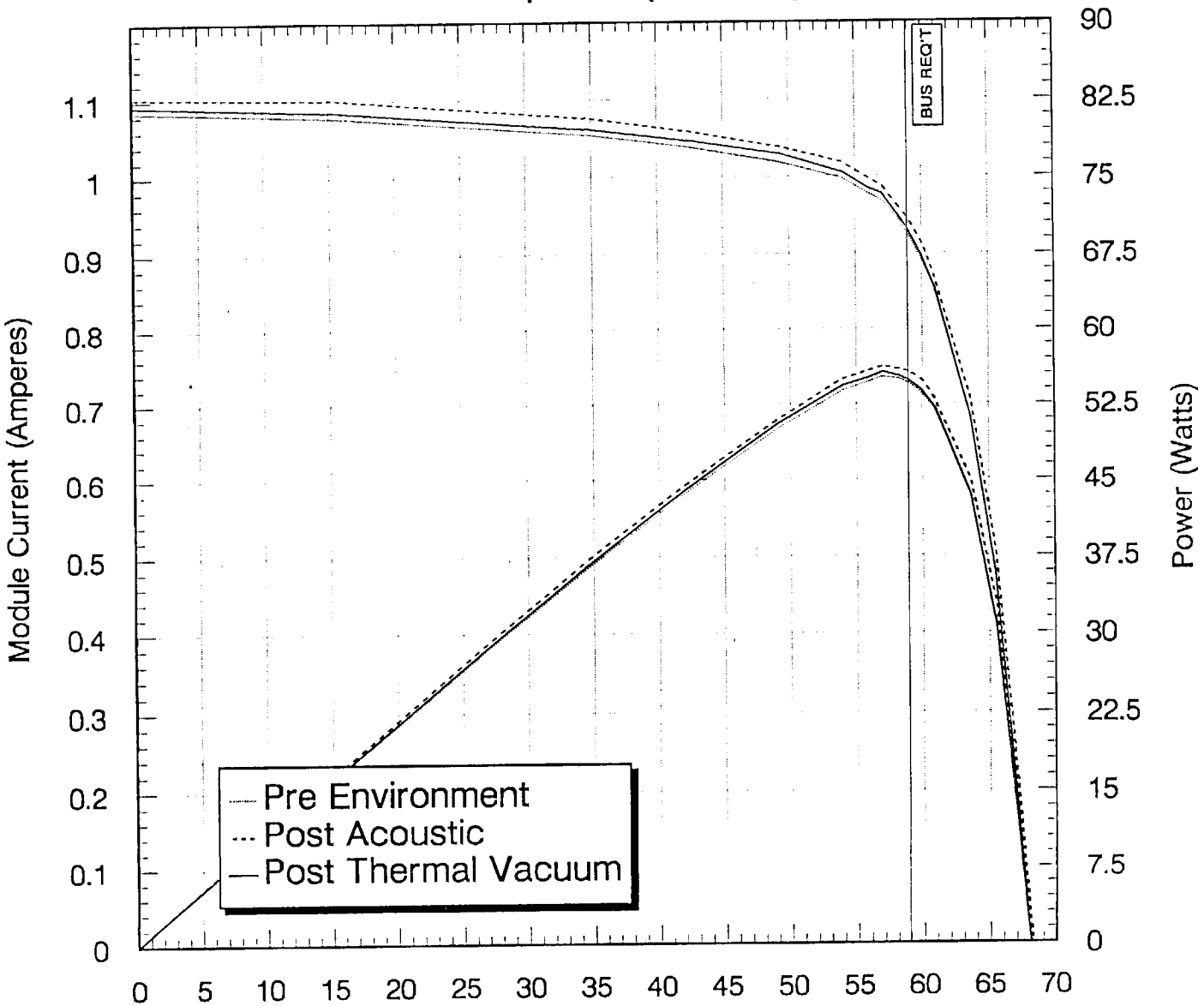
String 33 & 34 Module Outputs for TRMM +Y outer panel (Drawing 828340-1)



(Line Item 13, file 340-3334)

CURRENT GROUPS 11 & 11

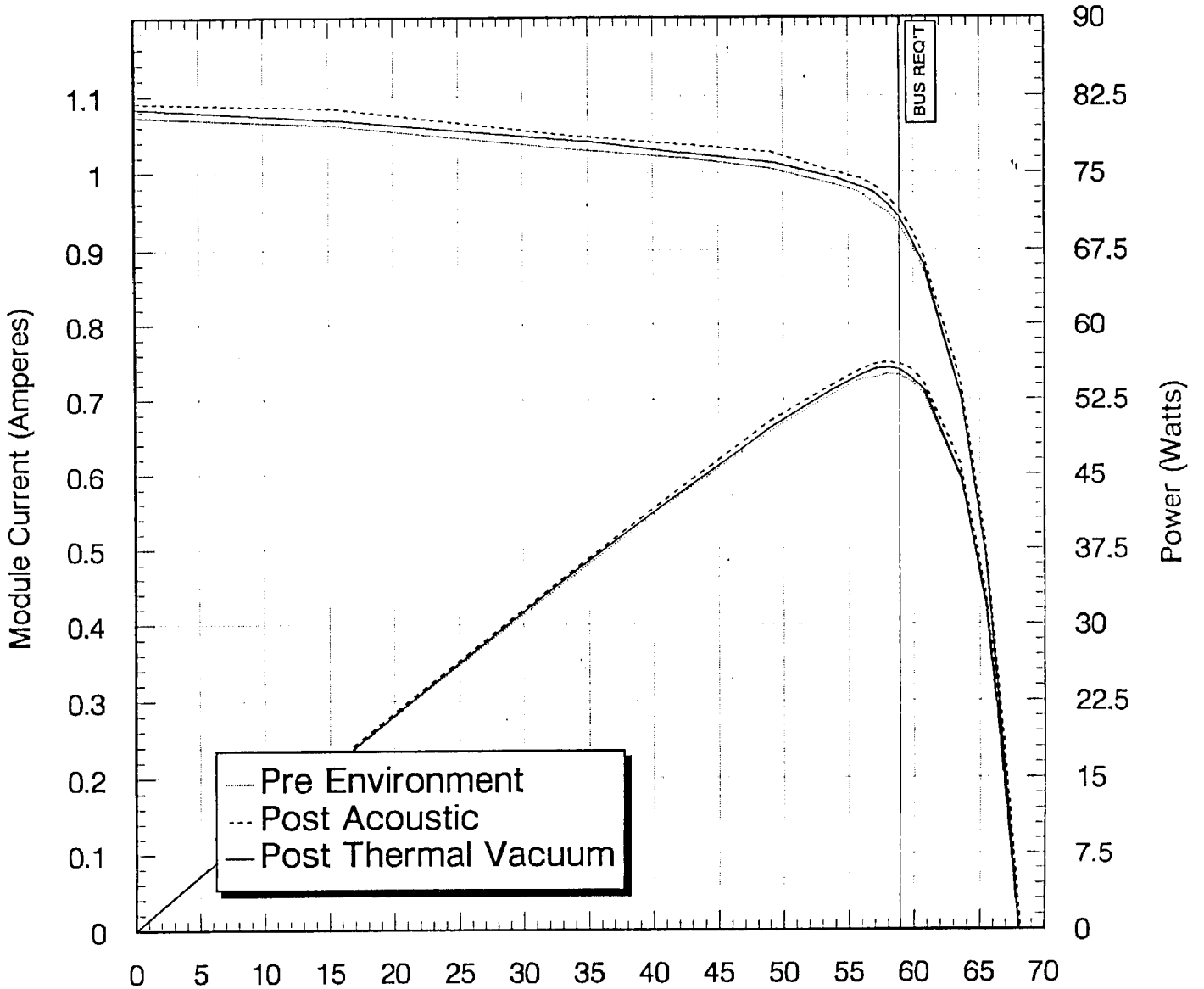
String 1 & 2 Module Outputs for TRMM +Y inner panel (Drawing 828360-1)



(Line Item 1, file 360-0102)

CURRENT GROUPS 6 & 5

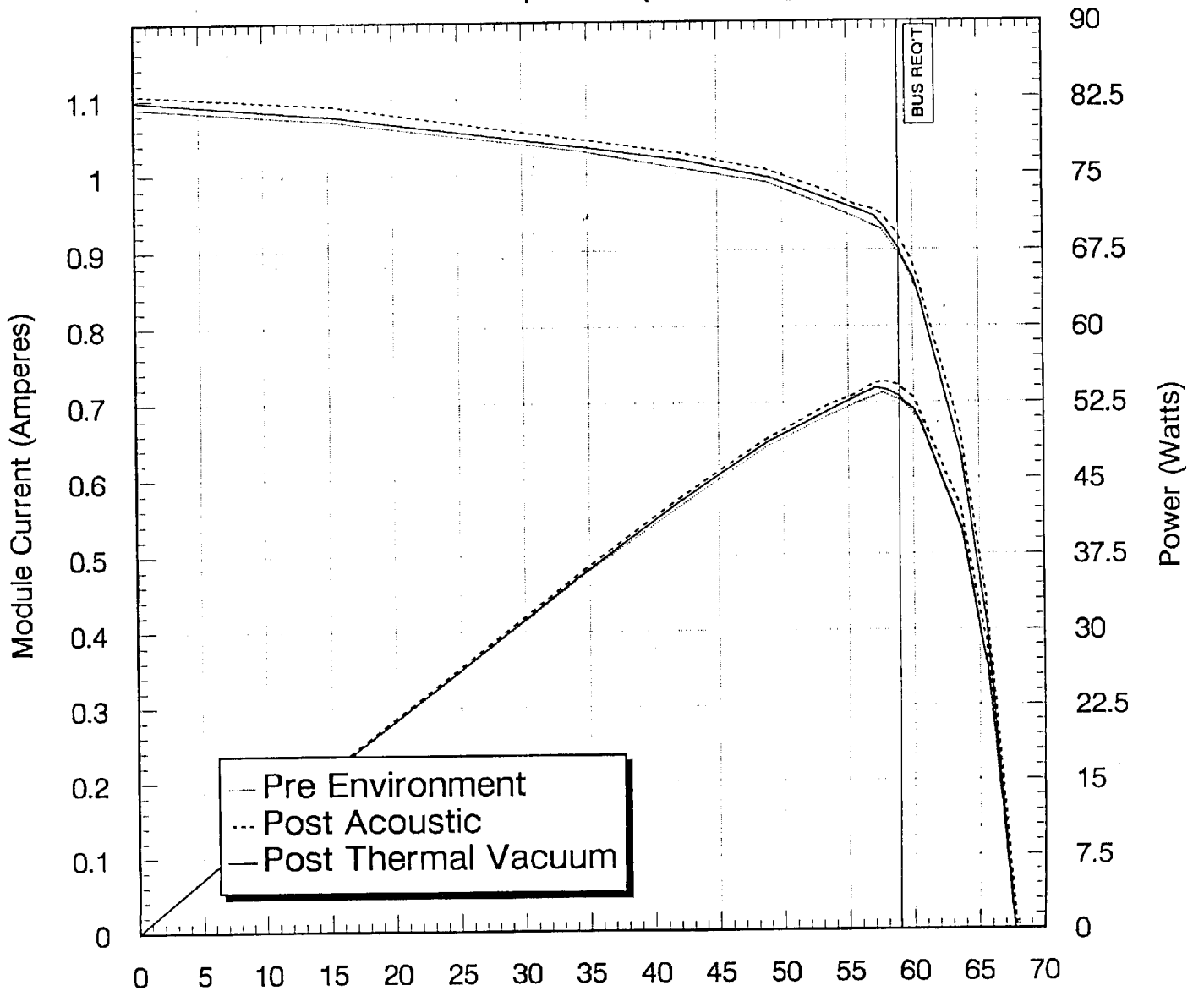
String 3 & 4 Module Outputs for TRMM +Y inner panel (Drawing 828360-1)



(Line Item 14, file 360-0304)

CURRENT GROUPS 5 & 4

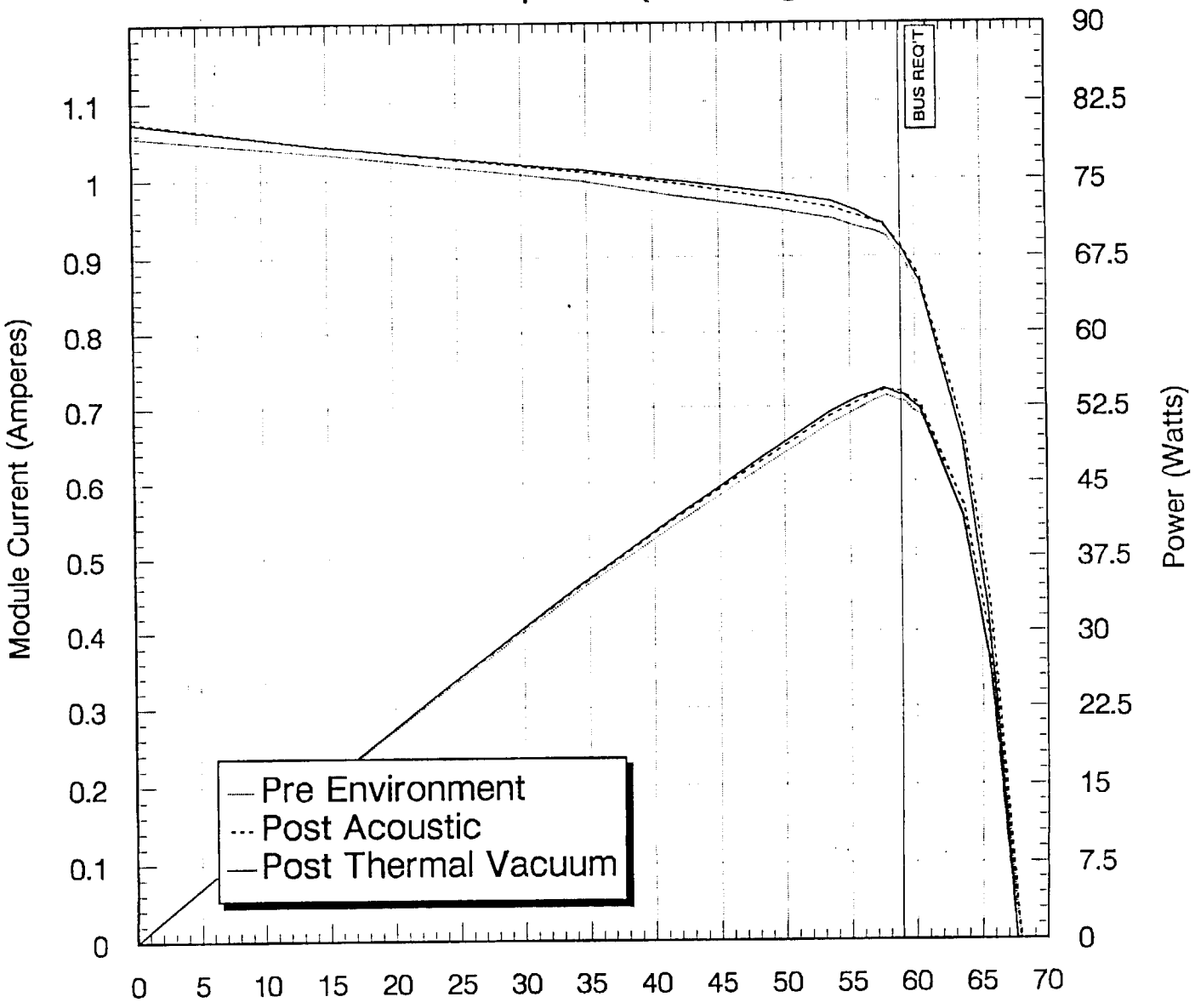
String 5 & 6 Module Outputs for TRMM +Y inner panel (Drawing 828360-1)



(Line Item 2, file 360-0506)

CURRENT GROUPS 2 & 2

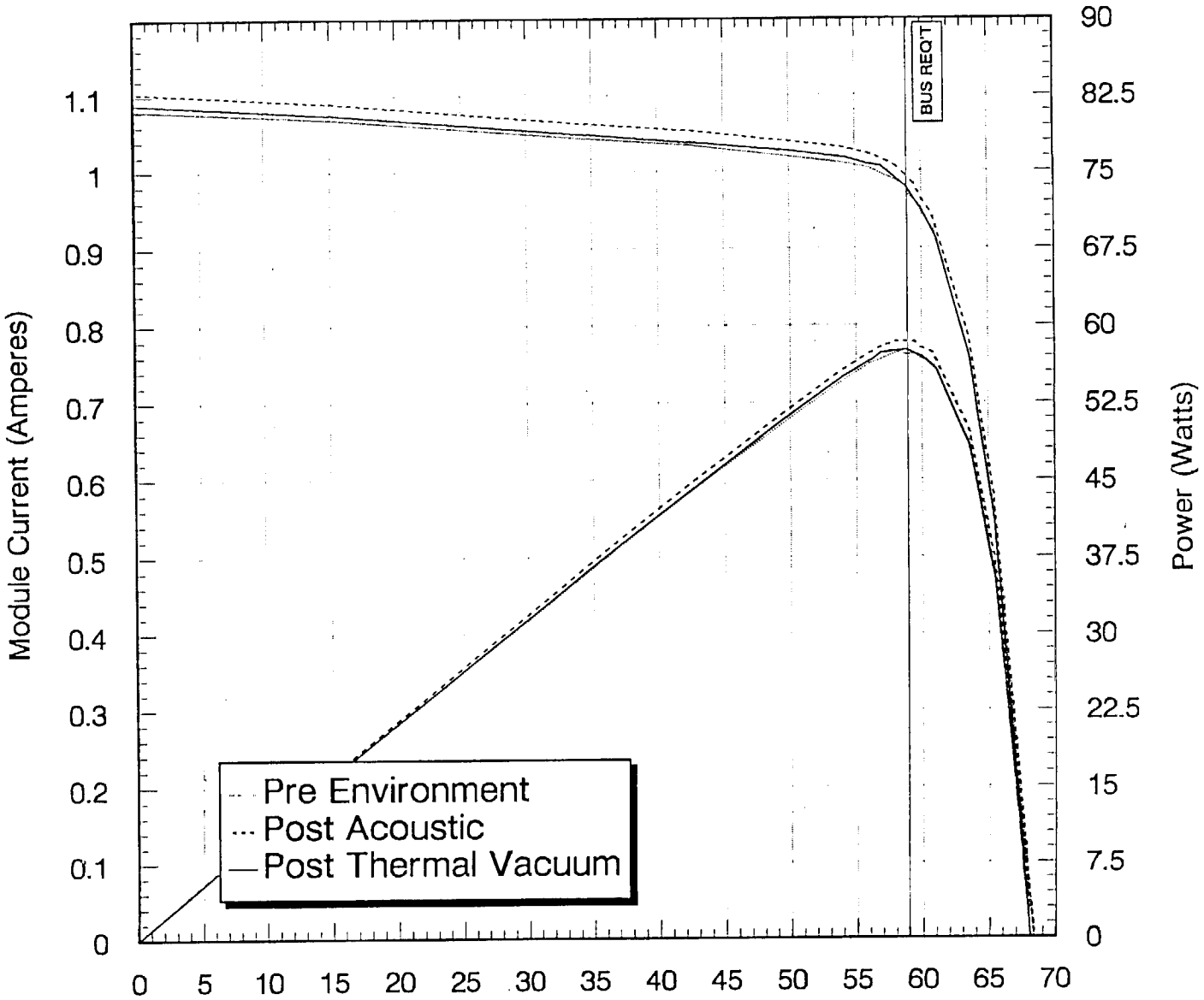
String 7 & 29 Module Outputs for TRMM +Y inner panel (Drawing 828360-1)



(Line Item 16, file 360-0729)

CURRENT GROUPS 1 & 3

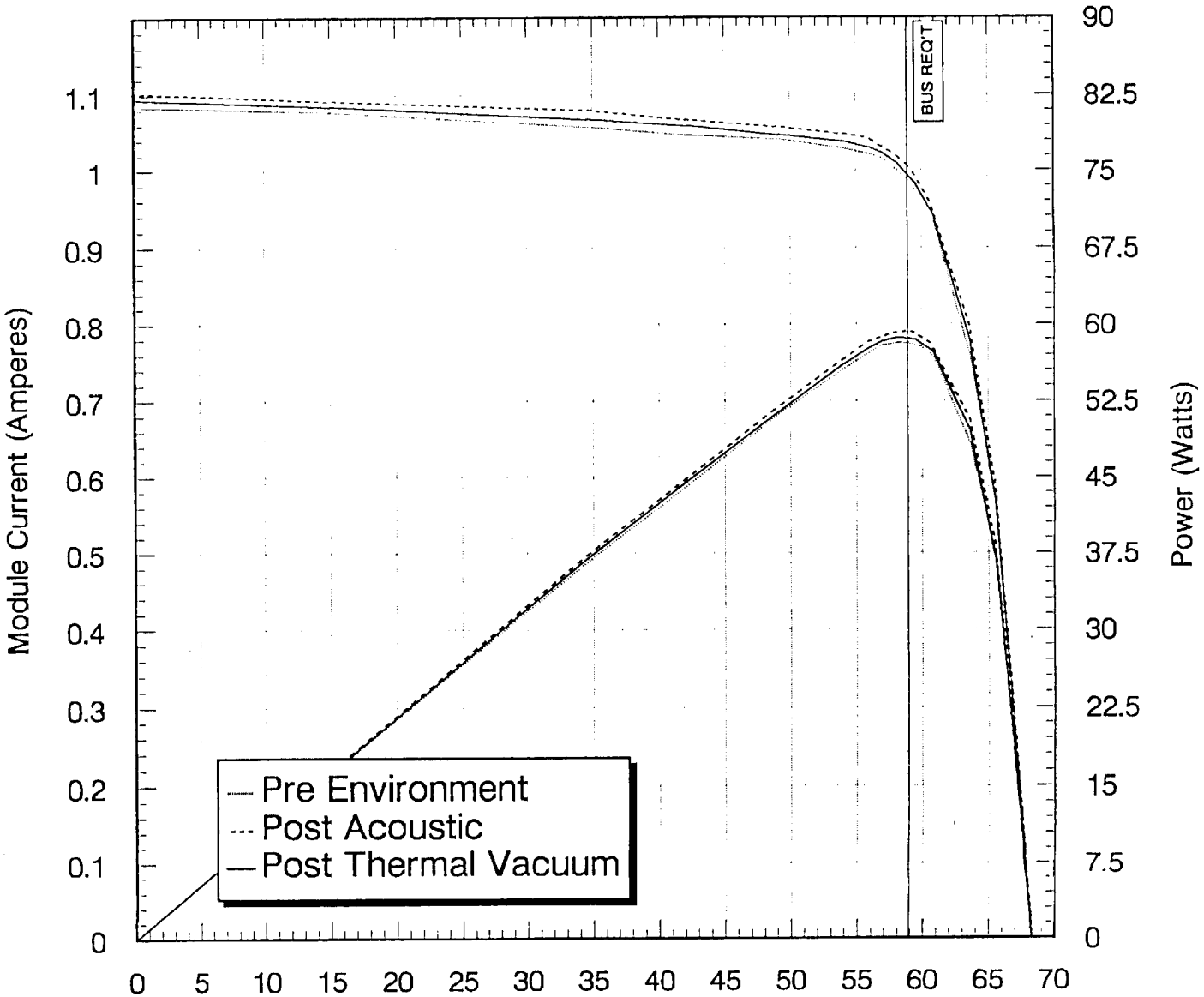
String 8 & 9 Module Outputs for TRMM +Y inner panel (Drawing 828360-1)



(Line Item 3, file 360-0809)

CURRENT GROUPS 1, 2, 3 & 8

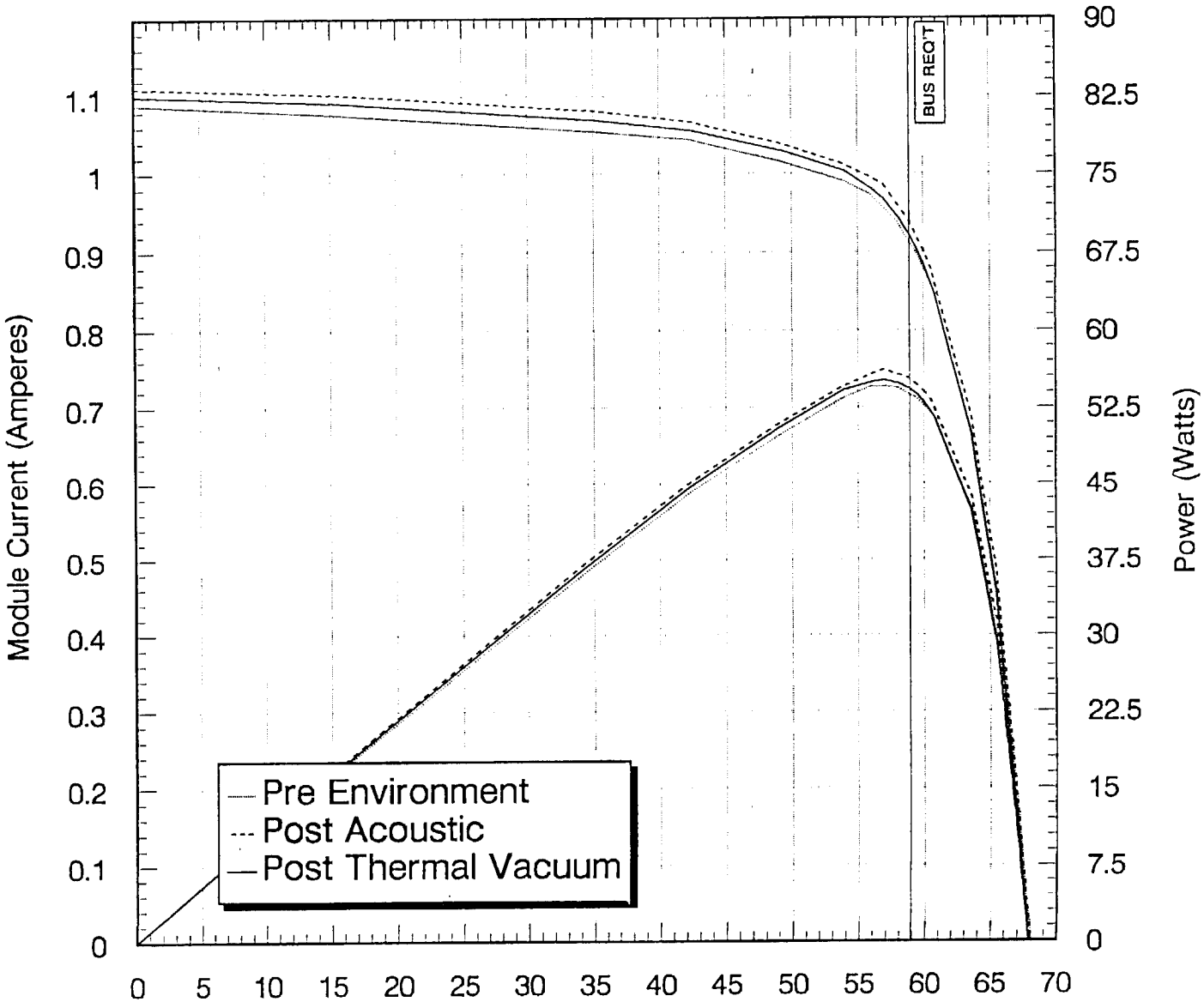
String 10 & 11 Module Outputs for TRMM +Y inner panel (Drawing 828360-1)



(Line Item 15, file 360-1011)

CURRENT GROUPS 9,10 & 4

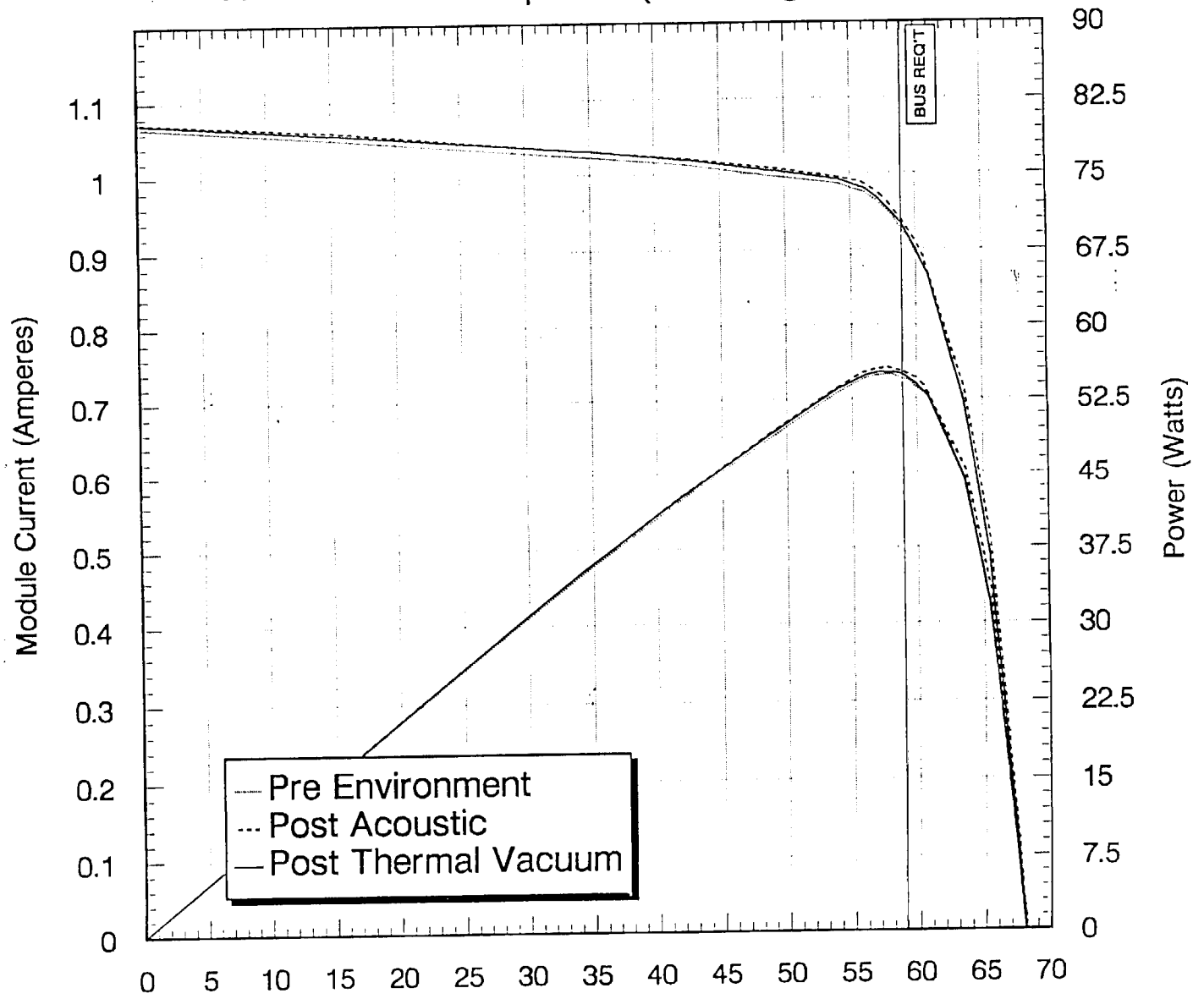
String 12 & 13 Module Outputs for TRMM +Y inner panel (Drawing 828360-1)



(Line Item 4, file 360-1213)

CURRENT GROUPS 4 & 5

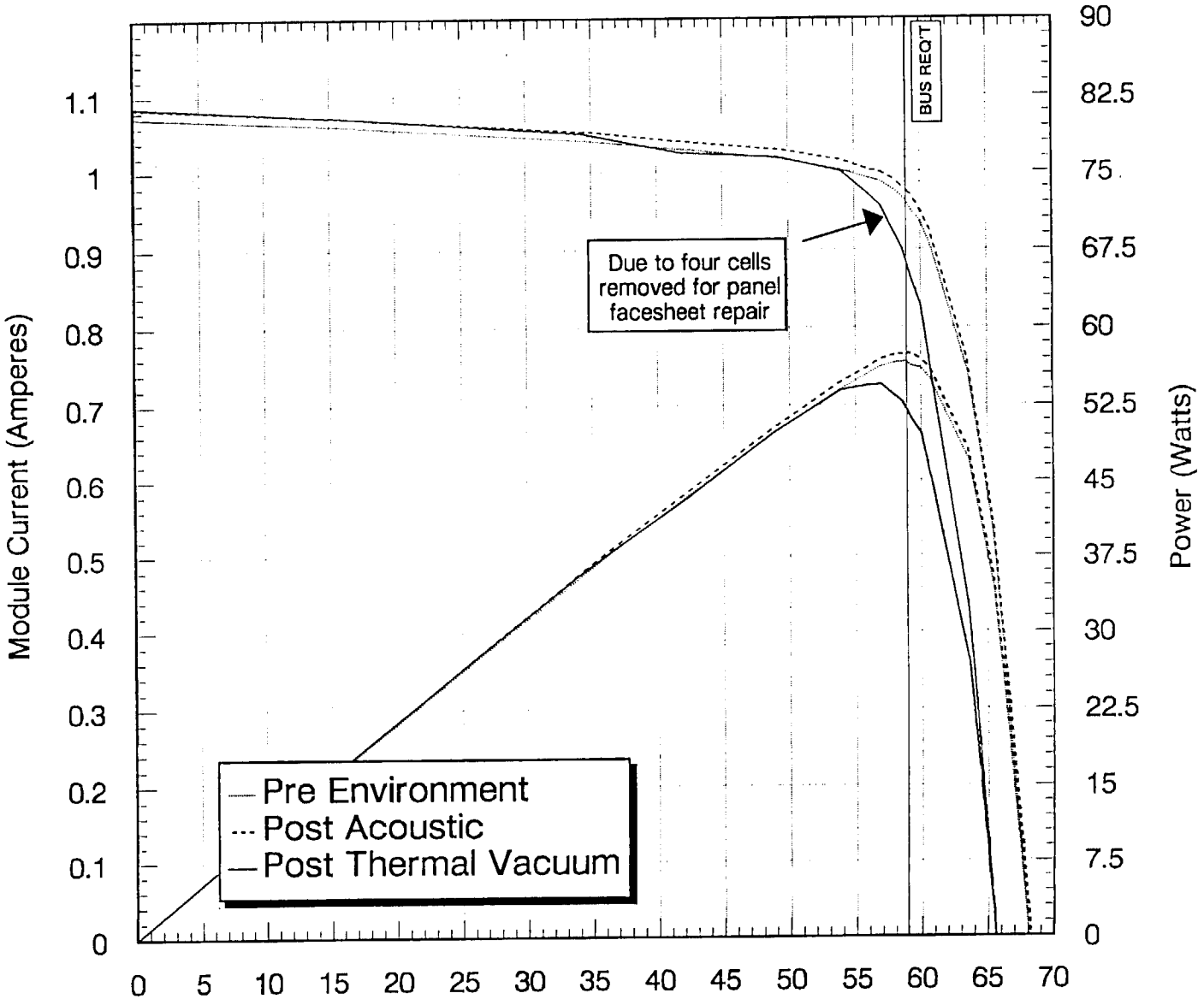
String 14 & 15 Module Outputs for TRMM +Y inner panel (Drawing 828360-1)



(Line Item 5, file 360-1415)

CURRENT GROUPS 6 & 6

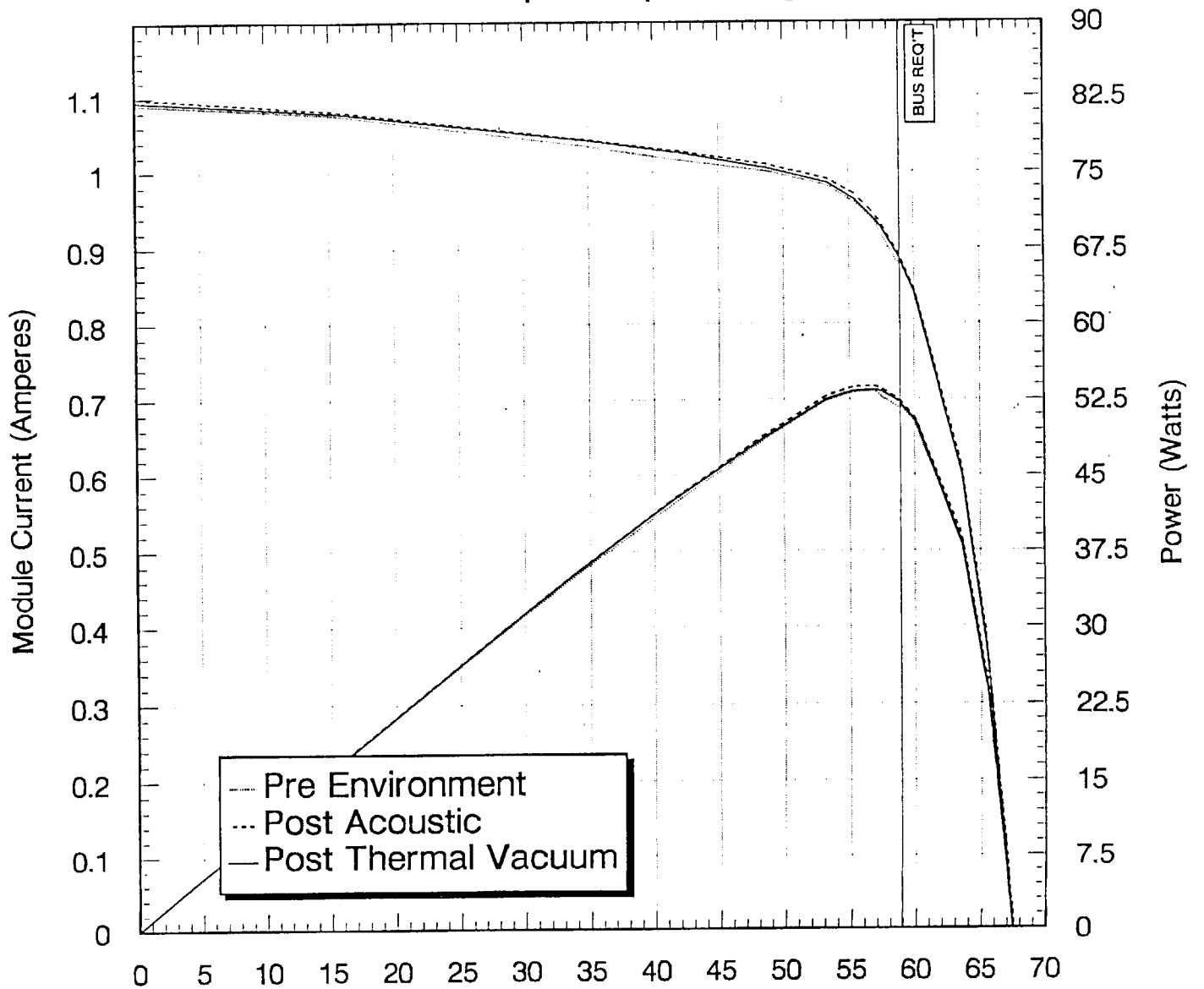
String 16 & 17 Module Outputs for TRMM +Y inner panel (Drawing 828360-1)



(Line Item 6, file 360-1617)

CURRENT GROUPS 5 & 7

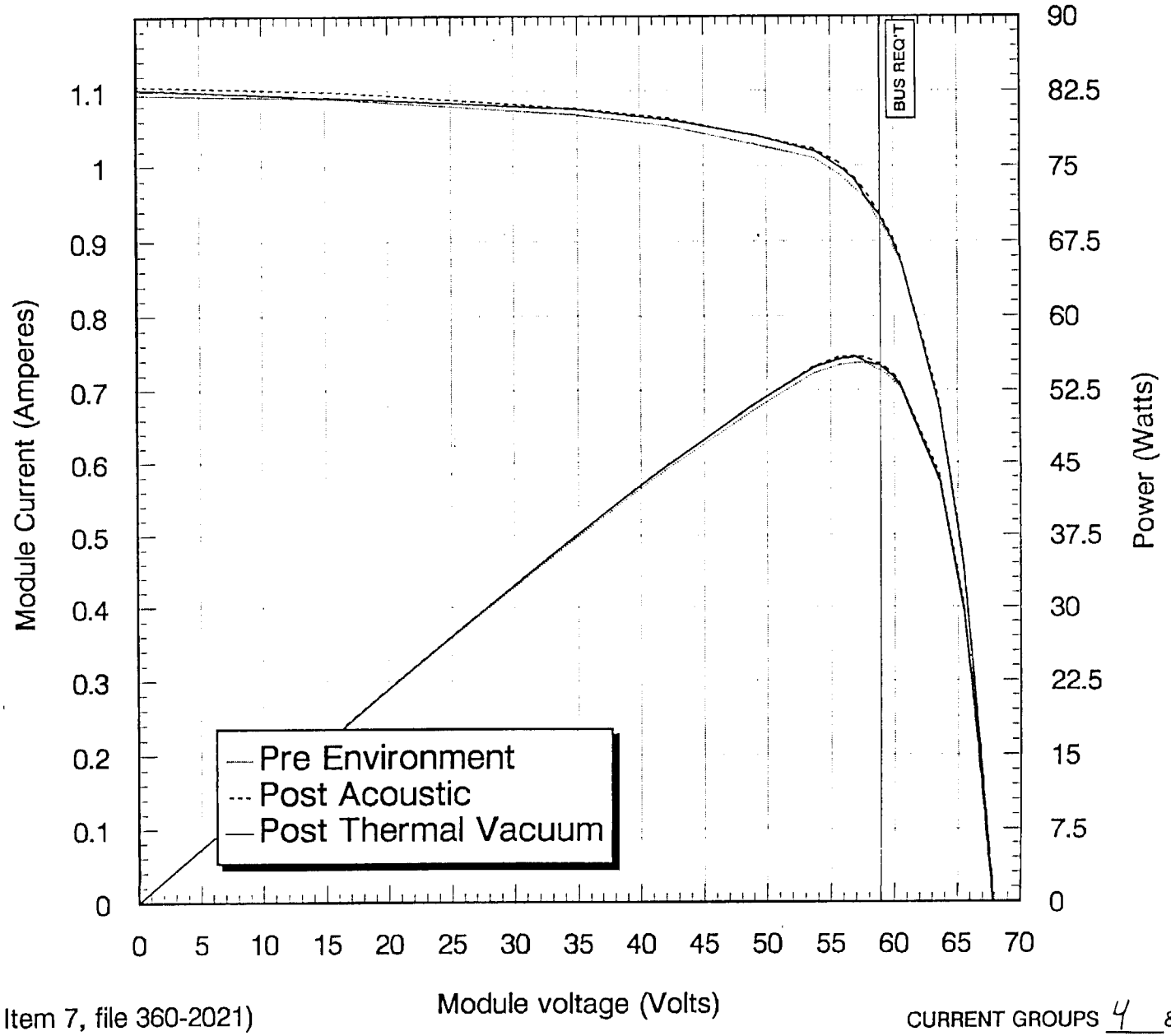
String 18 & 19 Module Outputs for TRMM +Y inner panel (Drawing 828360-1)



(Line Item 13, file 360-1819)

CURRENT GROUPS 1 & 1

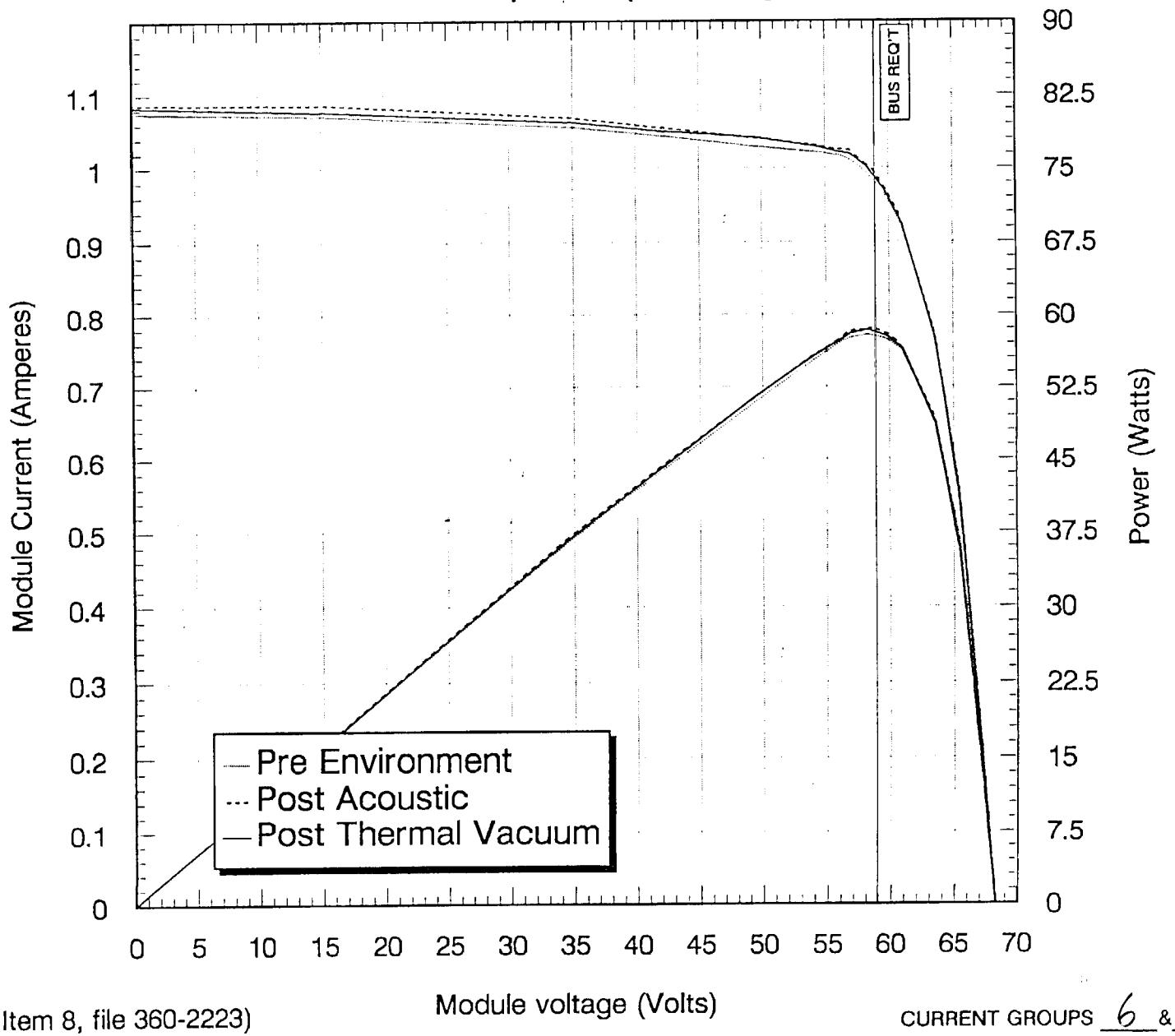
String 20 & 21 Module Outputs for TRMM +Y inner panel (Drawing 828360-1)



(Line Item 7, file 360-2021)

CURRENT GROUPS 4 & 5

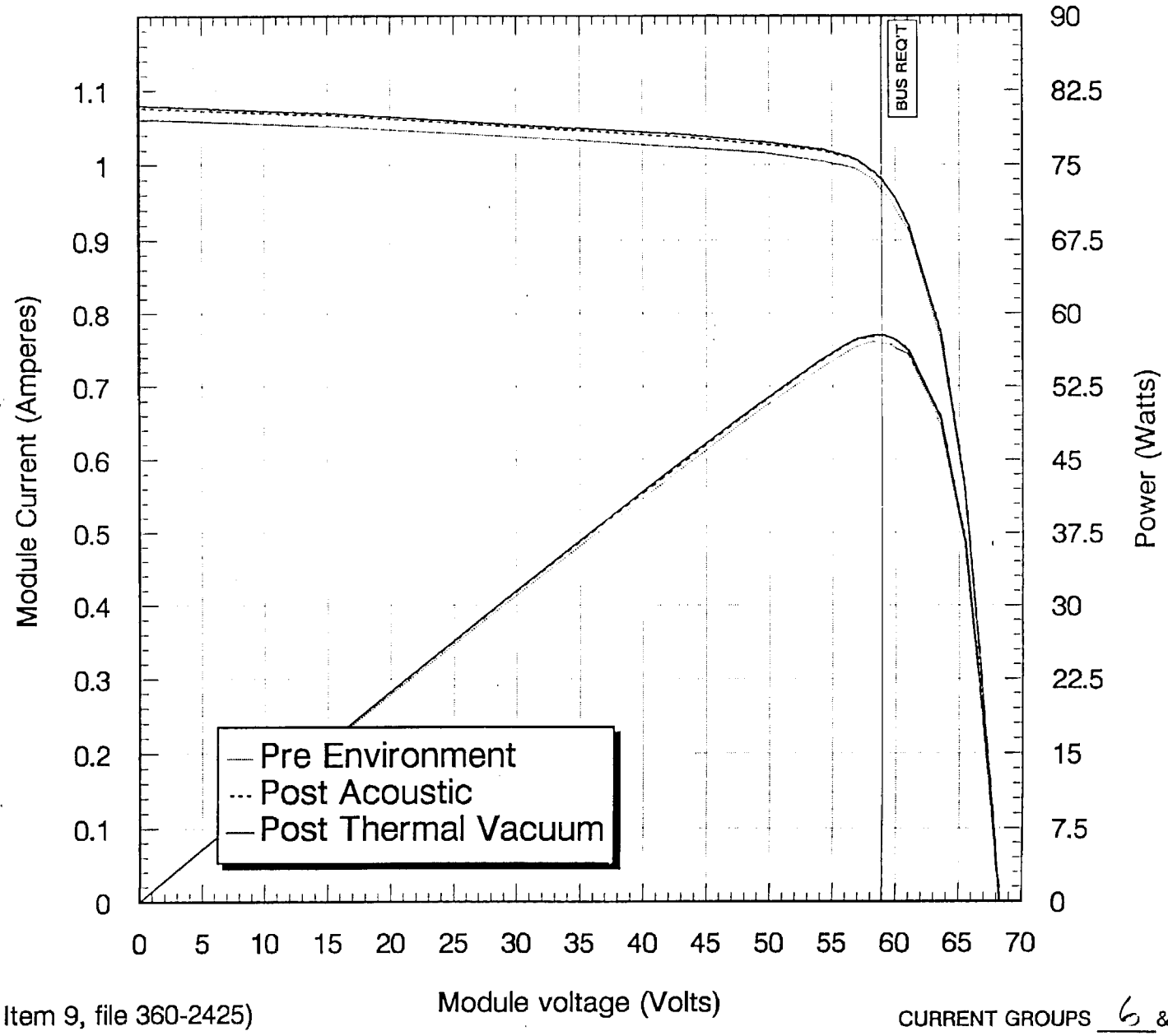
String 22 & 23 Module Outputs for TRMM +Y inner panel (Drawing 828360-1)



(Line Item 8, file 360-2223)

CURRENT GROUPS 6 & 8

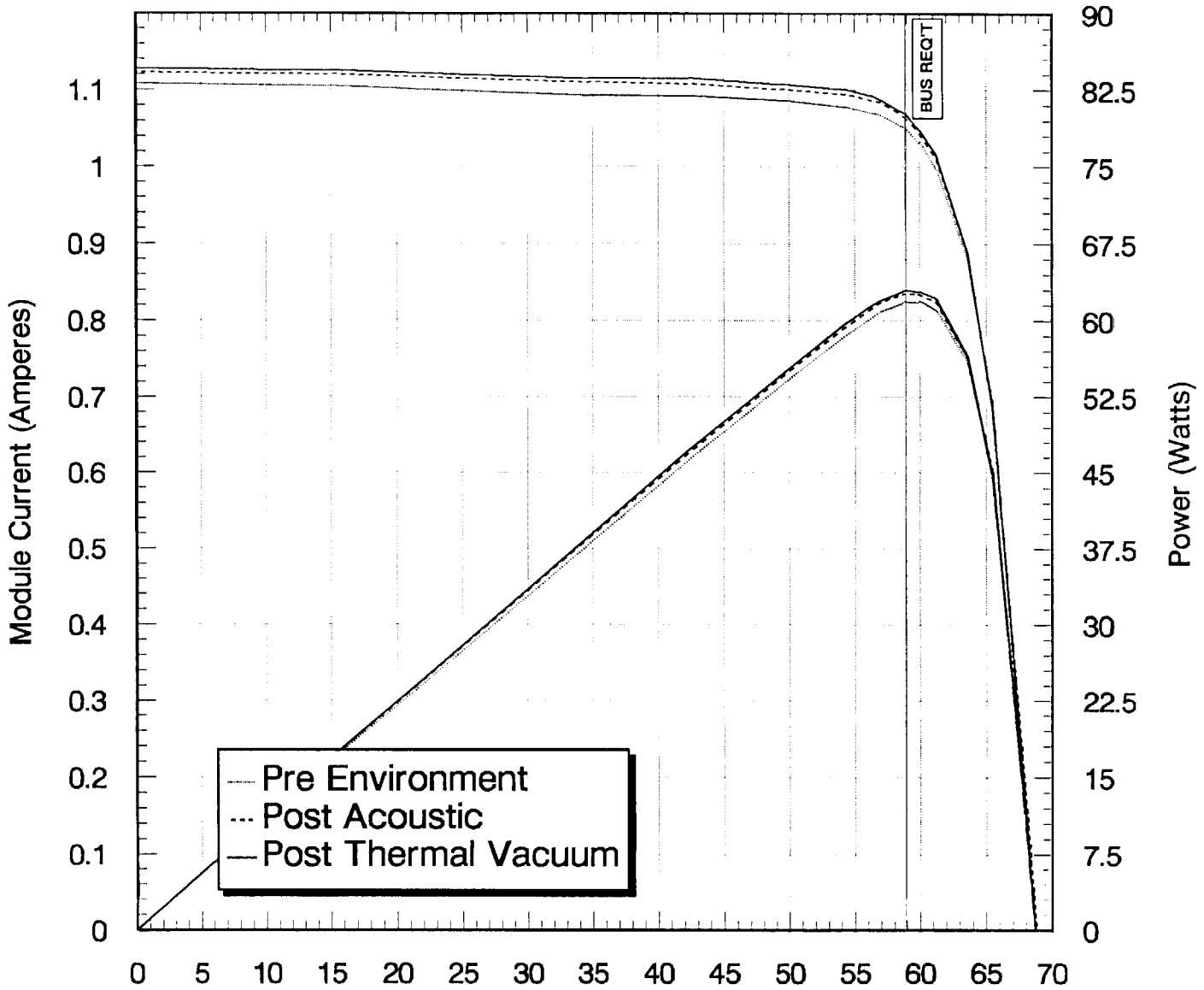
String 24 & 25 Module Outputs for TRMM +Y inner panel (Drawing 828360-1)



(Line Item 9, file 360-2425)

CURRENT GROUPS 6 & 7

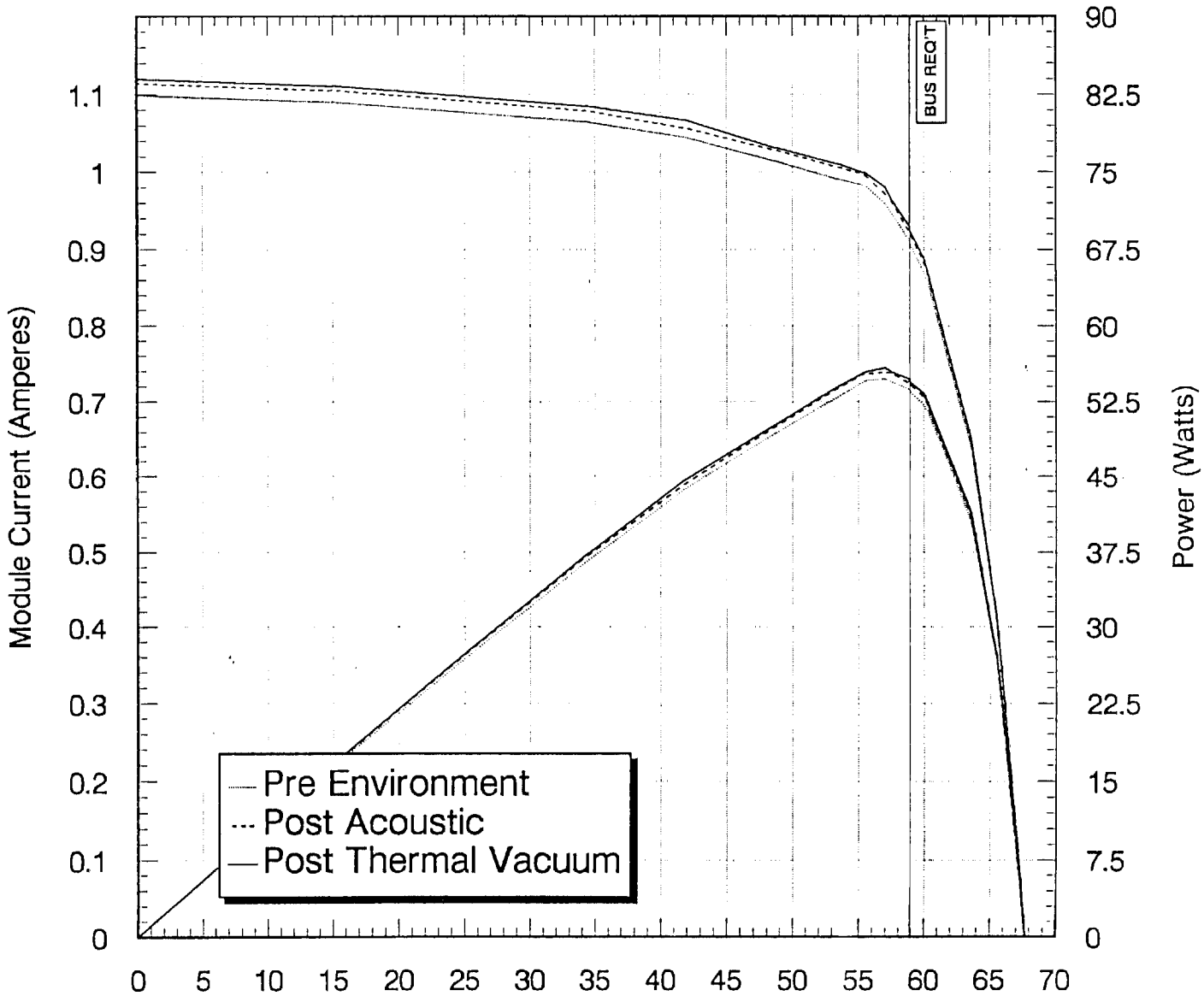
String 26 & 32 Module Outputs for TRMM +Y inner panel (Drawing 828360-1)



(Line Item 17, file 360-2632)

CURRENT GROUPS 12 & 12

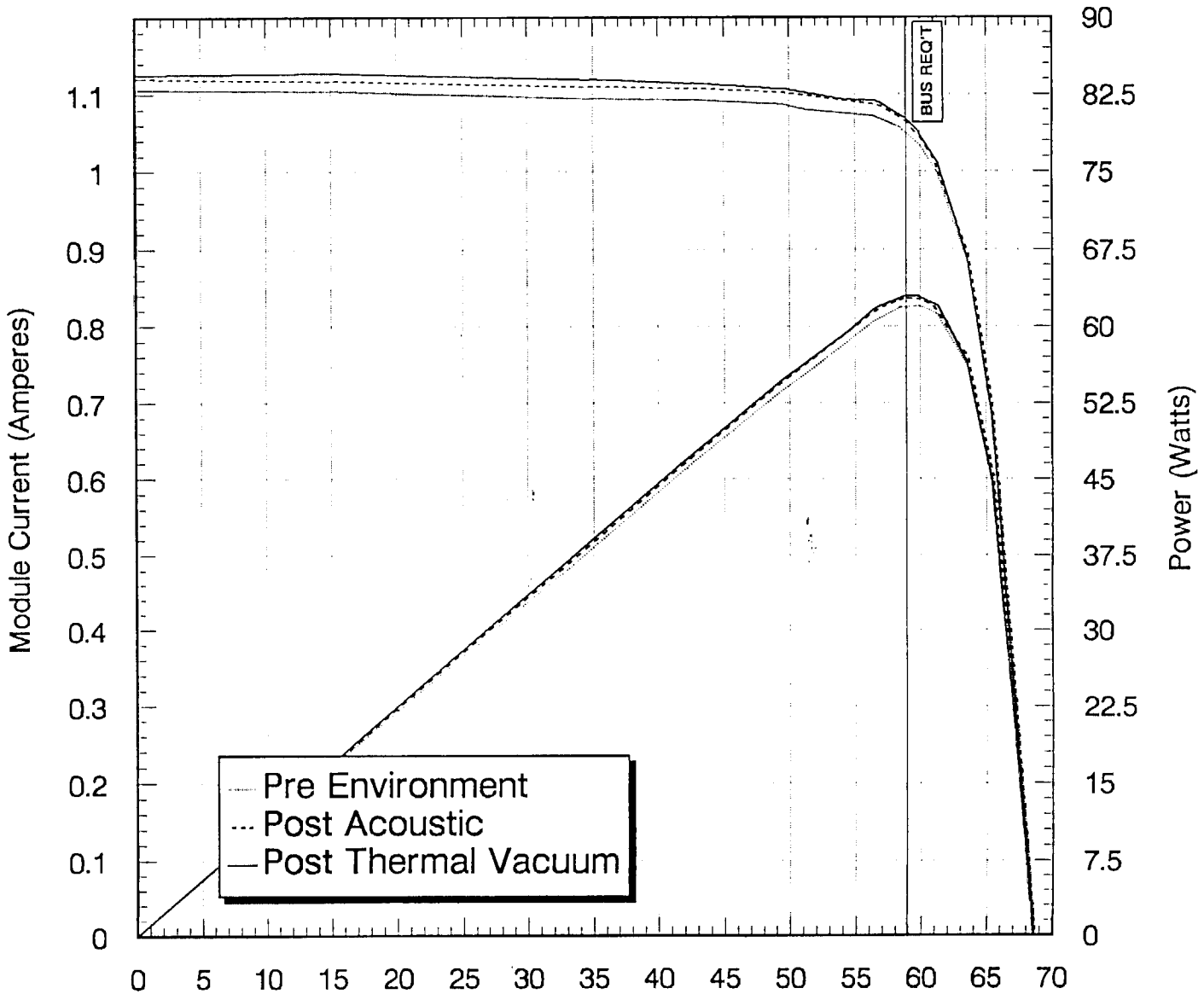
String 27 & 28 Module Outputs for TRMM +Y inner panel (Drawing 828360-1)



(Line Item 10, file 360-2728)

CURRENT GROUPS 3 & 3

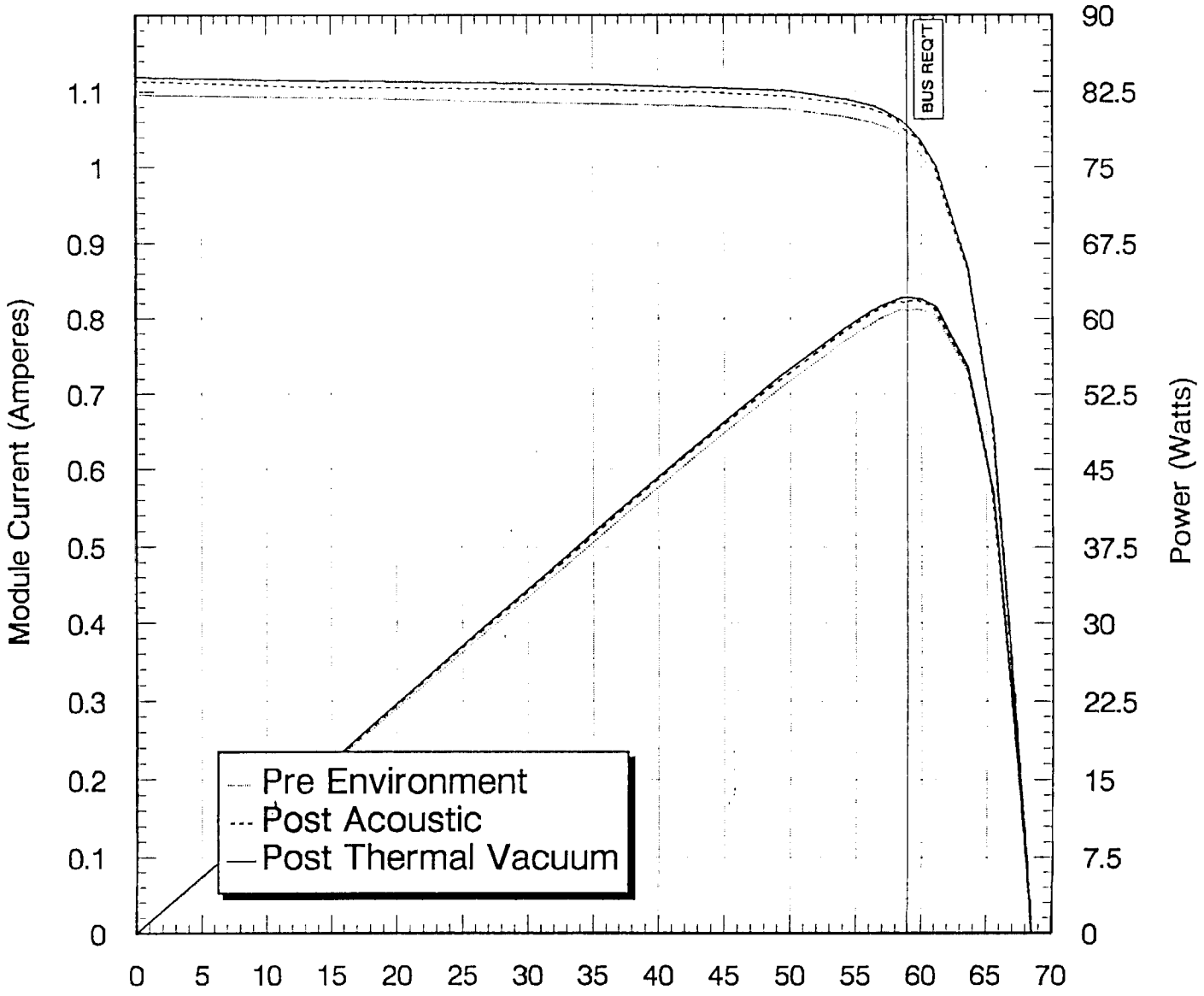
String 30 & 31 Module Outputs for TRMM +Y inner panel (Drawing 828360-1)



(Line Item 11, file 360-3031)

CURRENT GROUPS 10 & 11/12

String 33 & 34 Module Outputs for TRMM +Y inner panel (Drawing 828360-1)

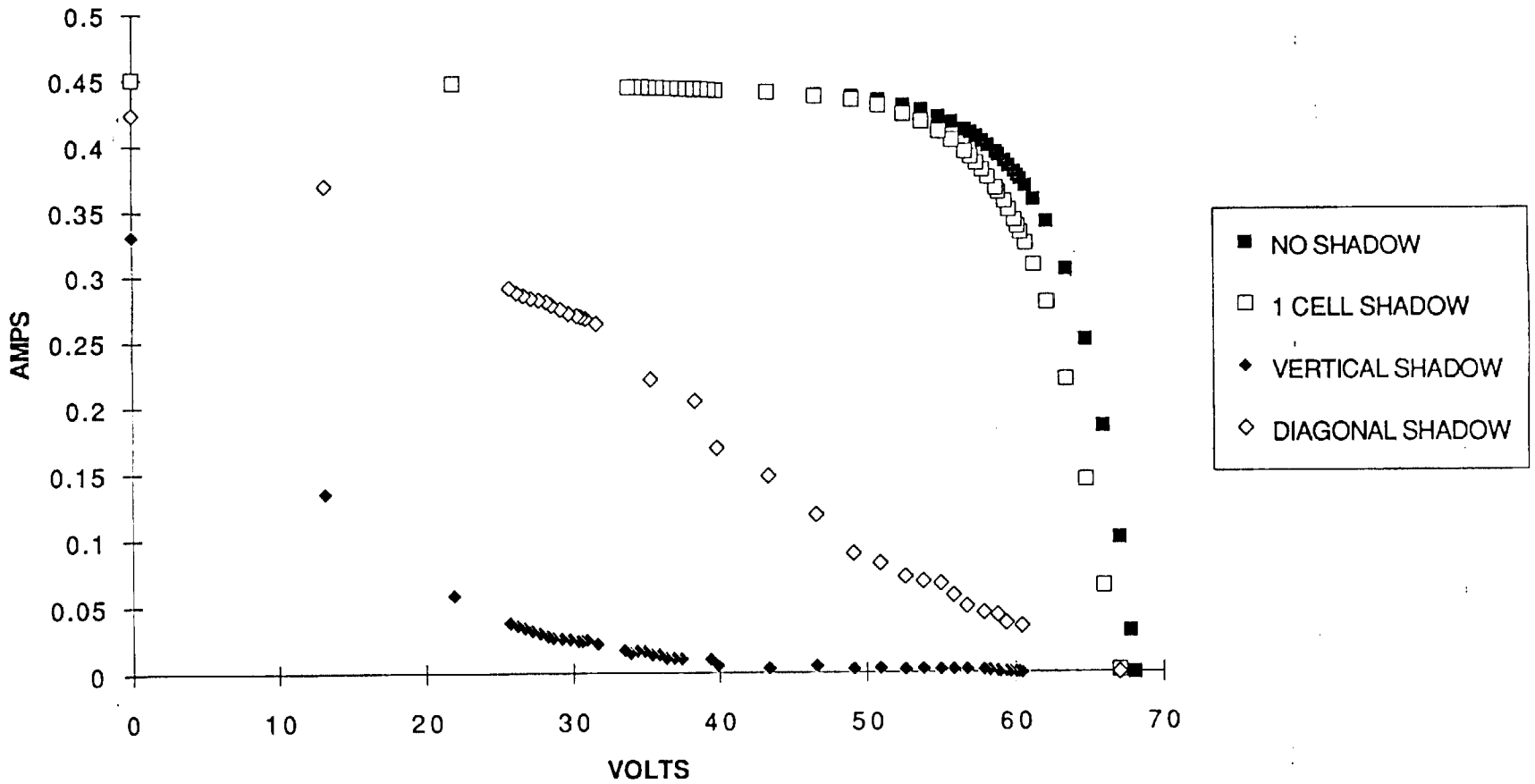


(Line Item 12, file 360-3334)

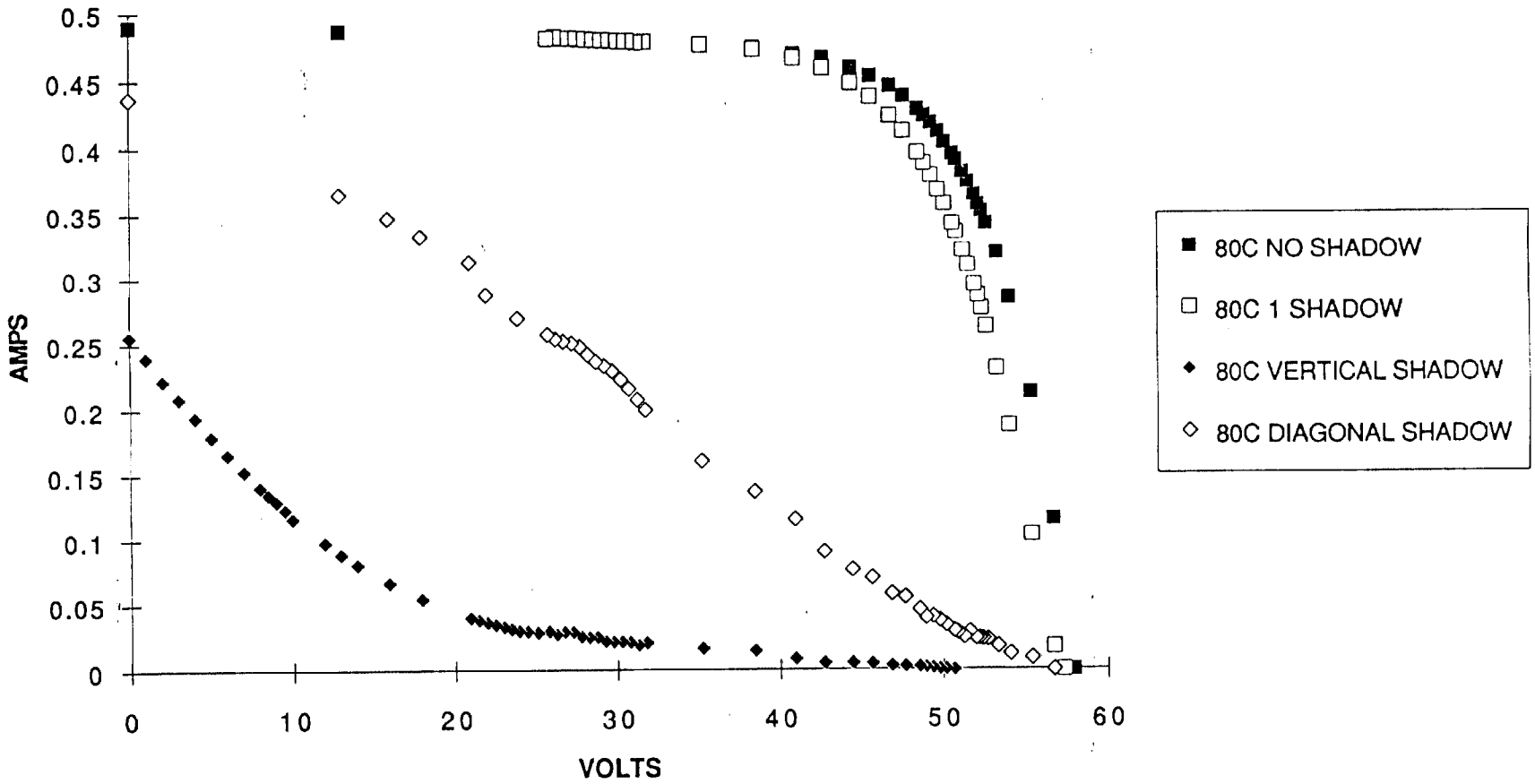
CURRENT GROUPS // & //

TEST ON STRING 2

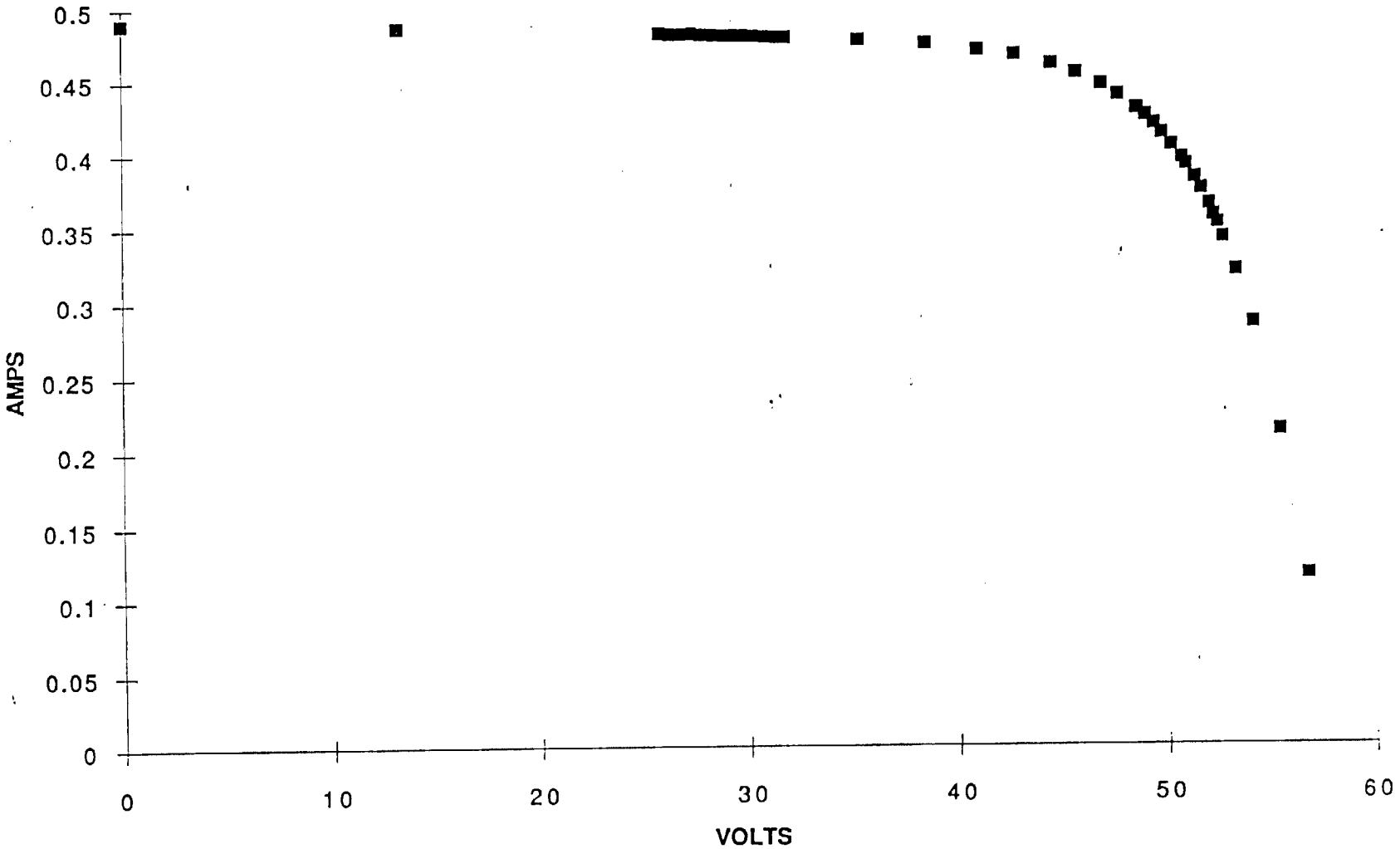
RT OVERLAY CHART2



80C OVERLAY CHART2



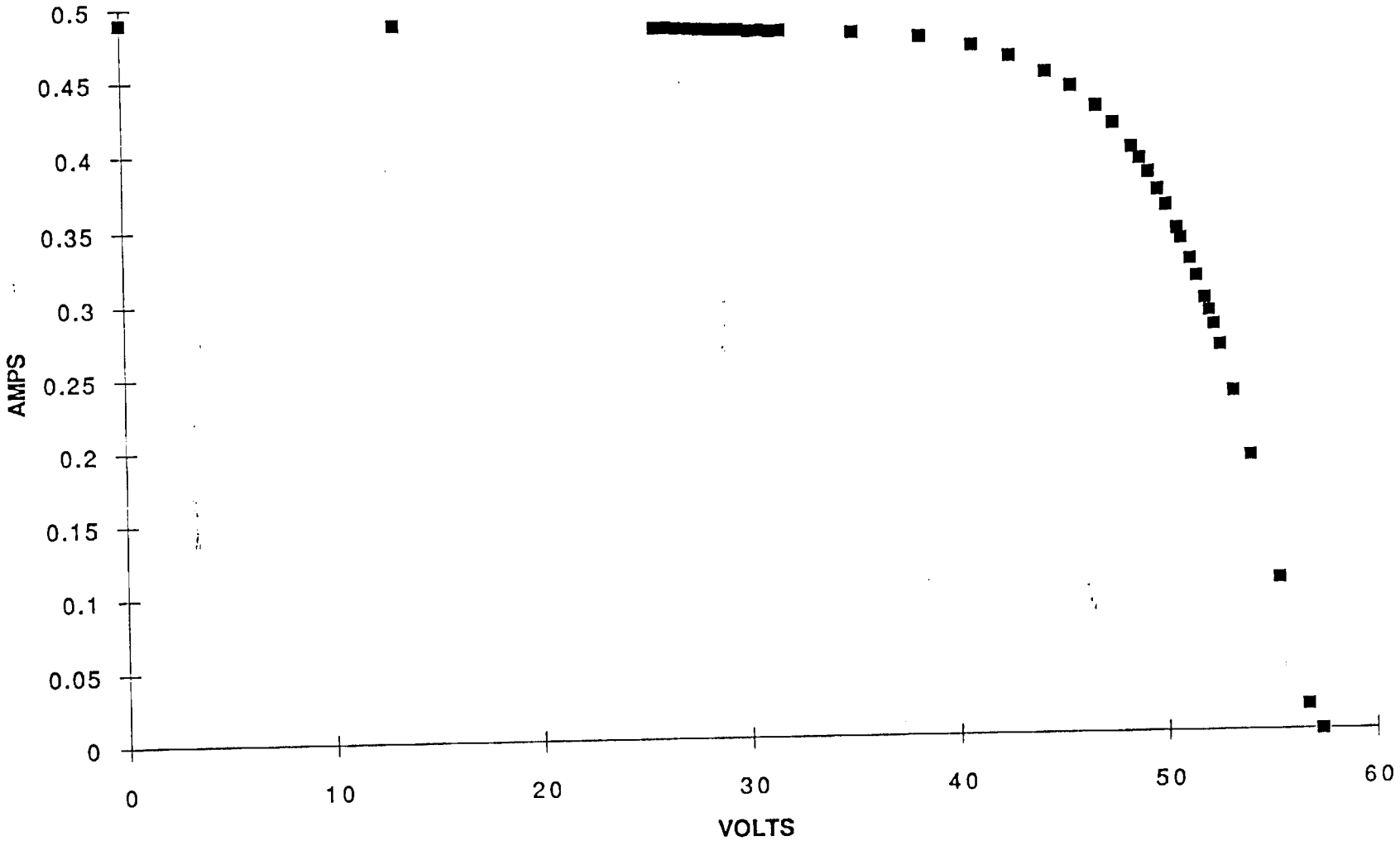
80C NO SH. LOW CHART2



80C NO SHADOW2

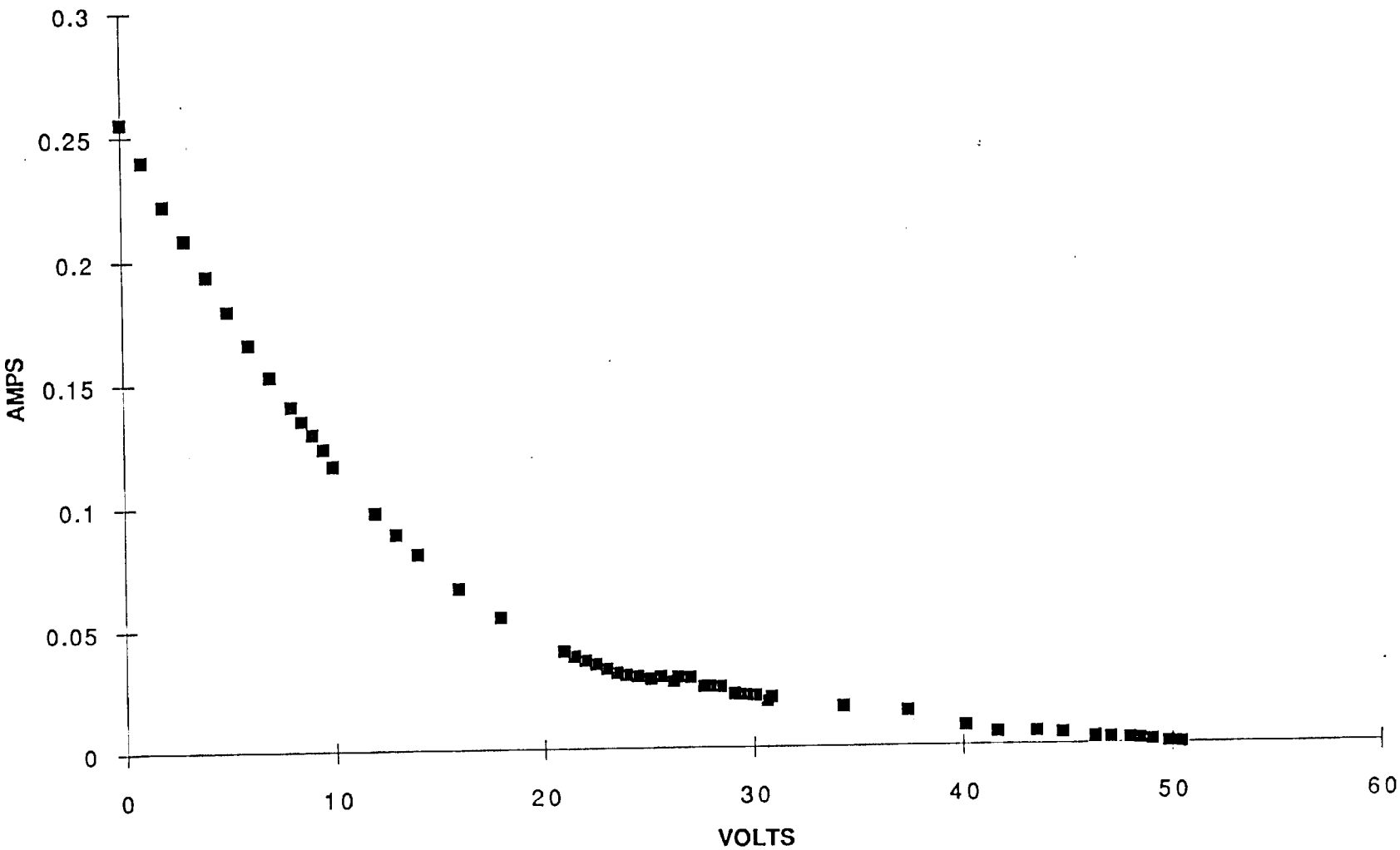
56.67	0.1161
55.36	0.2129
54.08	0.2844
53.28	0.3196
52.65	0.3423
52.38	0.3521
52.18	0.3572
51.97	0.3645
51.58	0.3748
51.28	0.3823
50.88	0.3914
50.68	0.396
50.19	0.4047
49.73	0.4126
49.35	0.4189
48.95	0.4243
48.55	0.4291
47.65	0.4386
46.87	0.446
45.66	0.4538
44.48	0.46
42.75	0.4666
40.95	0.4699
38.47	0.4746
35.27	0.4772
31.77	0.4791
31.29	0.4792
30.75	0.4795
30.26	0.48
29.75	0.4801
29.26	0.4801
28.76	0.4803
28.27	0.4807
27.76	0.4809
27.27	0.4817
26.76	0.4814
26.26	0.4815
25.77	0.482
13.17	0.4865
0	0.4899

80C 1 CELL SHADOW CHART2



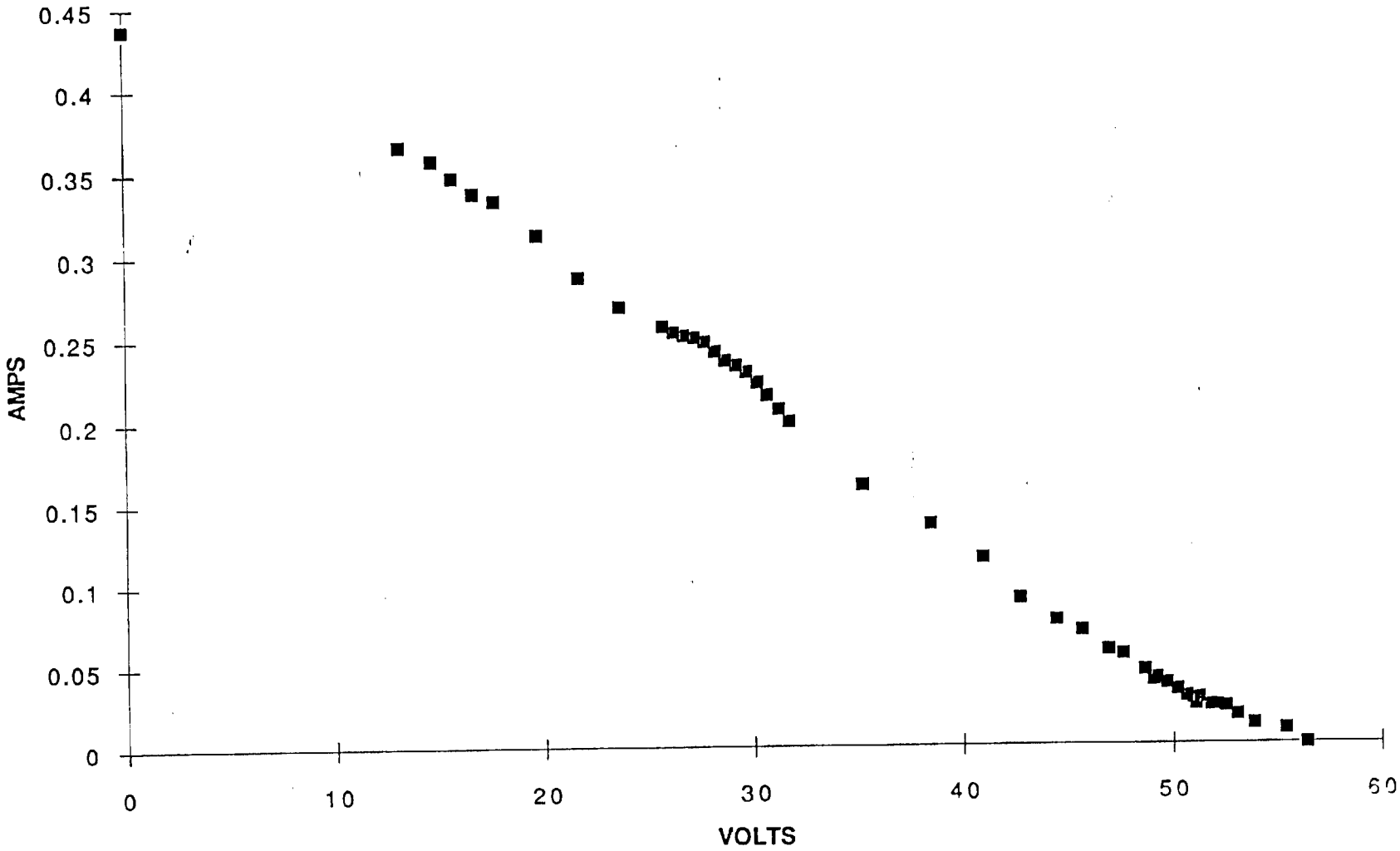
80C 1 CELL SHADOW2

57.33	0.0003
56.68	0.0171
55.37	0.1035
54.07	0.1875
53.3	0.2312
52.68	0.2626
52.39	0.2765
52.18	0.2861
51.98	0.2948
51.59	0.3099
51.29	0.3214
50.88	0.3358
50.68	0.3422
50.18	0.3578
49.8	0.3681
49.37	0.3795
48.95	0.3889
48.57	0.3966
47.67	0.4129
46.88	0.4245
45.67	0.4382
44.48	0.4482
42.76	0.4594
40.96	0.4668
38.48	0.4732
35.27	0.4769
31.78	0.4792
31.29	0.4788
30.76	0.4794
30.28	0.4793
29.77	0.4801
29.27	0.4804
28.77	0.4804
28.28	0.4808
27.77	0.4812
27.28	0.4815
26.78	0.4818
26.29	0.4823
25.78	0.4819
13.16	0.4868
0	0.4899


0.3
0.25
0.2
0.15
0.1
0.05
0
AMPS
0
10
20
30
40
50
60
VOLTS

50.42	0.0003
50.15	0.0005
49.83	0.0007
49.04	0.0017
48.41	0.0021
47.96	0.0025
47.04	0.0026
46.3	0.0031
44.74	0.0049
43.48	0.0054
41.63	0.0055
40.11	0.0084
37.36	0.0147
34.31	0.0166
30.85	0.0208
30.65	0.0192
30.08	0.0214
29.65	0.0215
29.34	0.0217
29.09	0.0222
28.4	0.0251
27.91	0.0253
27.63	0.0254
26.97	0.0289
26.39	0.0292
26.19	0.0275
25.55	0.0294
25.08	0.0286
24.44	0.0297
23.9	0.0302
23.47	0.0311
22.99	0.0329
22.46	0.0348
21.97	0.0364
21.45	0.0382
20.97	0.0402
17.95	0.0547
15.96	0.0666
13.99	0.0808
12.97	0.0888
11.96	0.0977
9.97	0.1168
9.5	0.1235
8.99	0.1297
8.499	0.1352
7.99	0.141
7	0.1529
6	0.166
5	0.1796
4	0.1941
3	0.2086
2	0.2224
1	0.24
0	0.2554

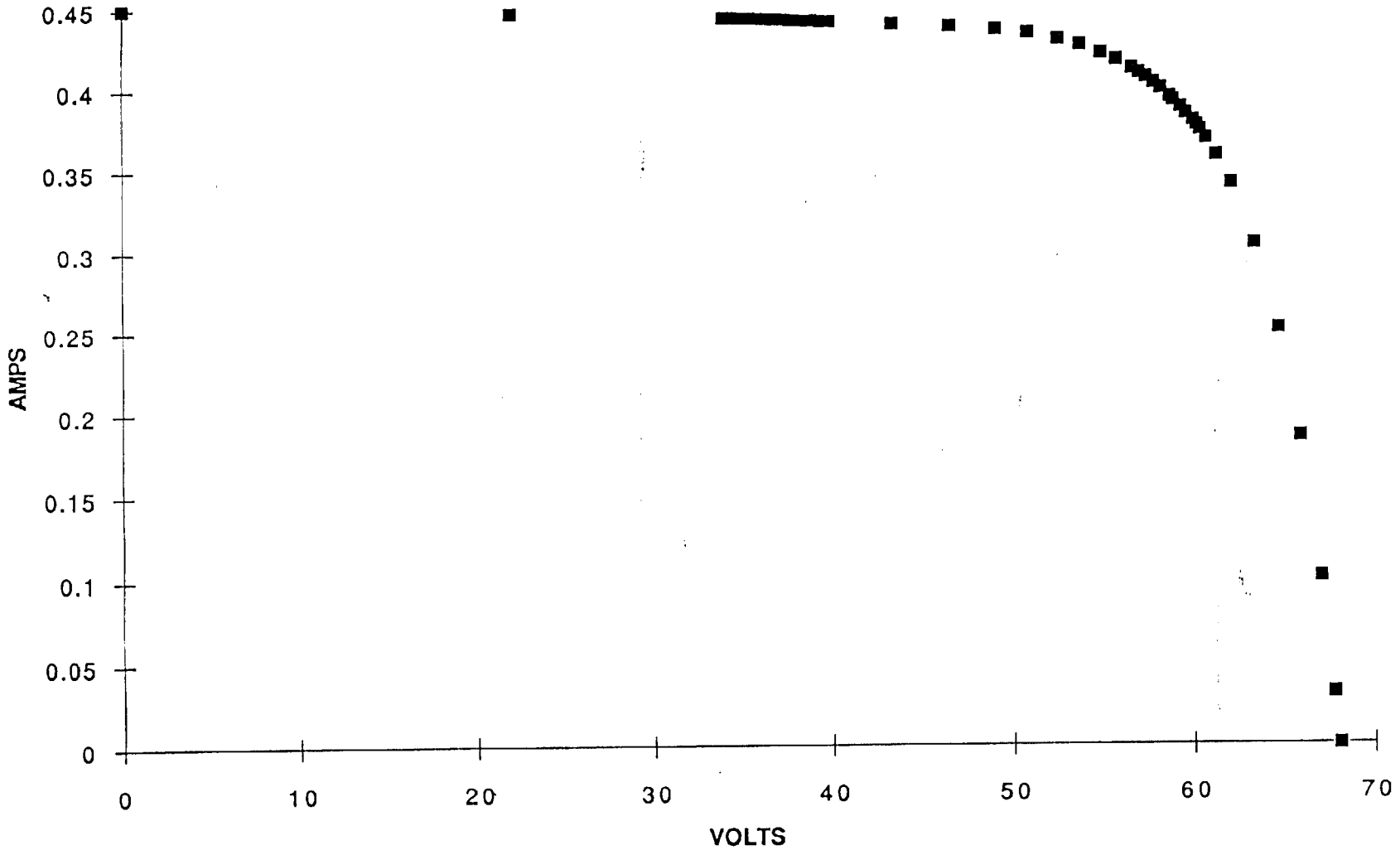
80C DI ONAL CHART2



80C DIAGONAL SHADOW2

56.38	0.0001
55.39	0.0088
53.87	0.0121
53.05	0.0176
52.5	0.0228
52.1	0.0235
51.92	0.0237
51.79	0.0238
51.23	0.0285
51.09	0.0247
50.94	0.0283
50.65	0.0295
50.21	0.0338
49.71	0.0375
49.21	0.0407
49.06	0.0395
48.64	0.0456
47.59	0.0555
46.9	0.0582
45.68	0.0702
44.47	0.0766
42.75	0.0904
40.98	0.1159
38.47	0.1371
35.26	0.1611
31.78	0.2
31.28	0.2077
30.74	0.216
30.26	0.2234
29.76	0.2297
29.26	0.2335
28.76	0.2367
28.27	0.2422
27.75	0.2481
27.27	0.2506
26.77	0.252
26.28	0.2538
25.77	0.2574
23.71	0.2696
21.72	0.2875
19.73	0.3128
17.71	0.3332
16.7	0.3378
15.7	0.347
14.72	0.3575
13.18	0.3657
0	0.437

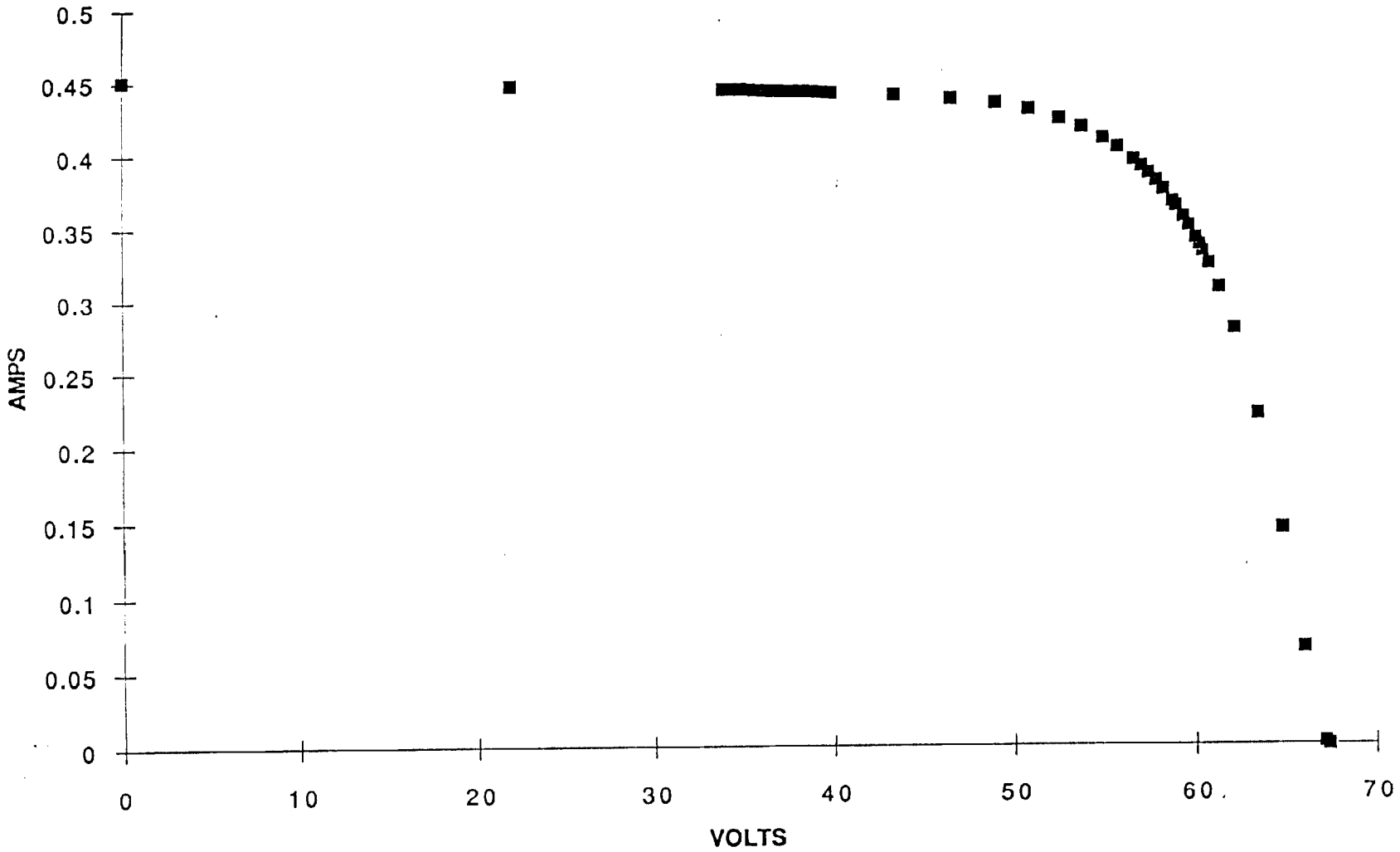
RT NO SHADOW CHART2



RT NO SHADOW2

volts	amps
68.08	0.0001
68.05	0.0002
67.77	0.031
67.05	0.1009
65.95	0.1851
64.78	0.2509
63.47	0.3043
62.18	0.3409
61.35	0.3581
60.77	0.3686
60.46	0.3737
60.26	0.3767
60.07	0.3797
59.67	0.3841
59.37	0.3879
58.97	0.3922
58.79	0.3945
58.27	0.3995
57.89	0.4029
57.48	0.4064
57.09	0.4092
56.7	0.4116
55.8	0.4172
54.97	0.4213
53.79	0.4263
52.57	0.4299
50.91	0.4338
49.12	0.4363
46.59	0.4381
43.4	0.4397
39.9	0.4414
39.4	0.4414
38.92	0.4419
38.41	0.4418
37.92	0.442
37.41	0.4423
36.93	0.4427
36.4	0.4427
35.91	0.443
35.4	0.4433
34.9	0.4434
34.4	0.4436
33.93	0.4438
21.94	0.4468
0	0.45

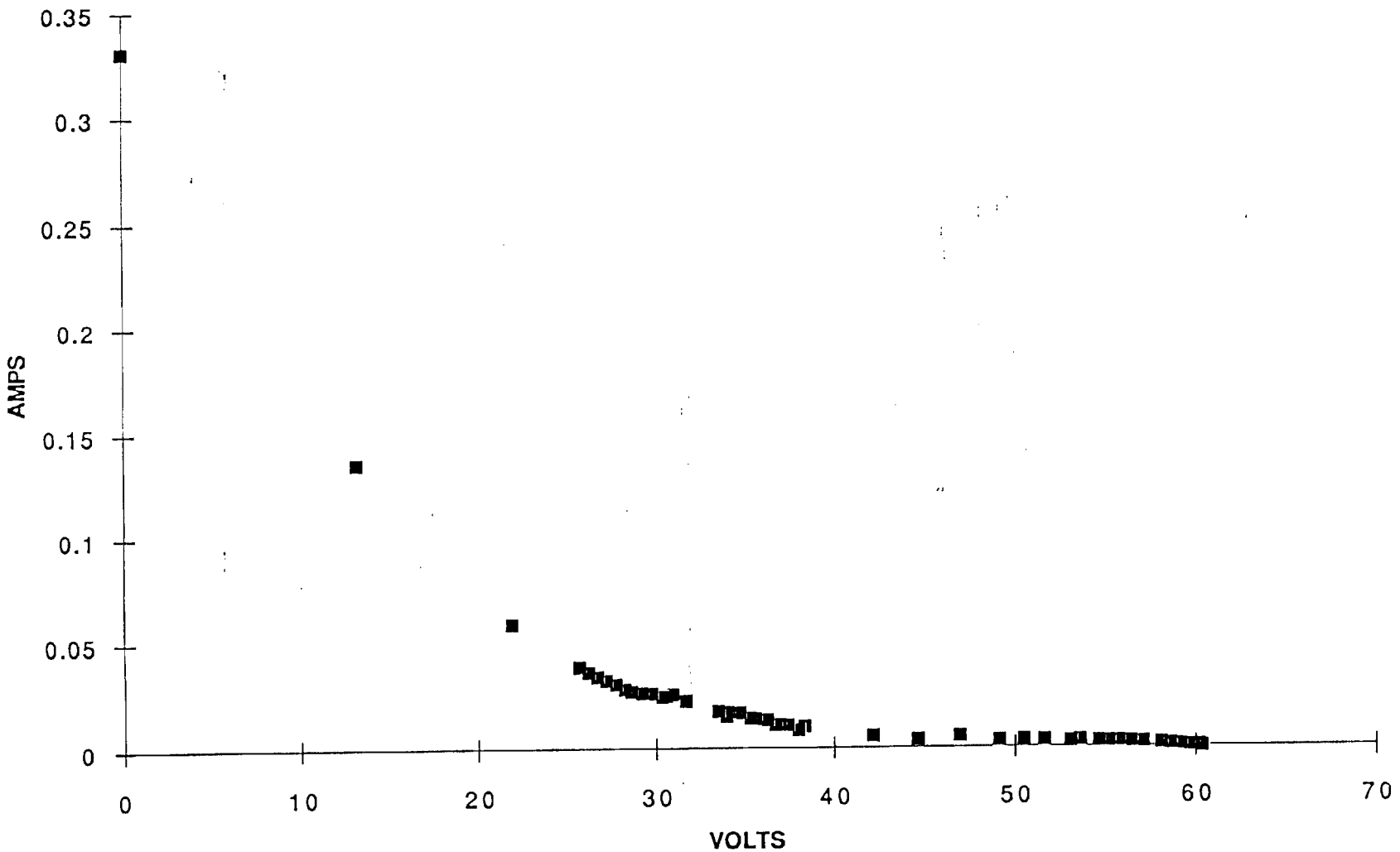
RT 1 CELL SHADOW CHART2



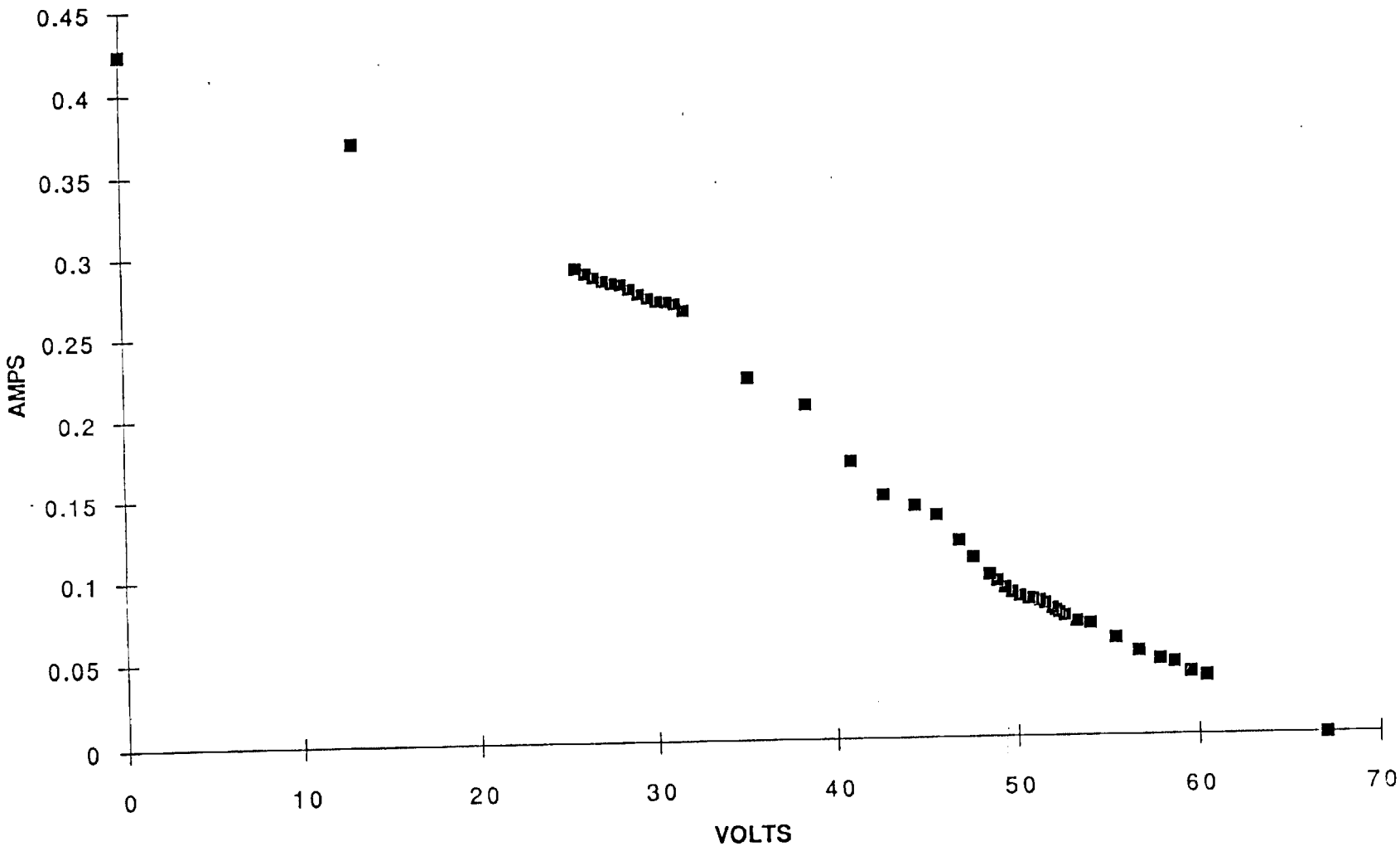
RT 1 CELL SHADOW2

67.41	0.0002
67.39	0.0003
67.39	0.0002
67.16	0.0019
66.01	0.0651
64.84	0.1452
63.53	0.2208
62.24	0.2787
61.4	0.3078
60.83	0.3245
60.52	0.3328
60.32	0.3375
60.11	0.3421
59.73	0.3504
59.43	0.3567
59.02	0.3639
58.84	0.367
58.32	0.3753
57.94	0.3809
57.53	0.3862
57.14	0.3909
56.74	0.395
55.84	0.4036
55.02	0.4101
53.83	0.4176
52.62	0.4233
50.95	0.4298
49.1	0.4342
46.62	0.4372
43.44	0.44
39.94	0.4415
39.44	0.4417
38.94	0.4421
38.45	0.4425
37.95	0.4426
37.44	0.4427
36.97	0.4431
36.42	0.4431
35.94	0.4434
35.43	0.4436
34.93	0.444
34.43	0.4439
33.95	0.4441
21.95	0.4469
0	0.4508

RT VERT. SHADOW. Chart2

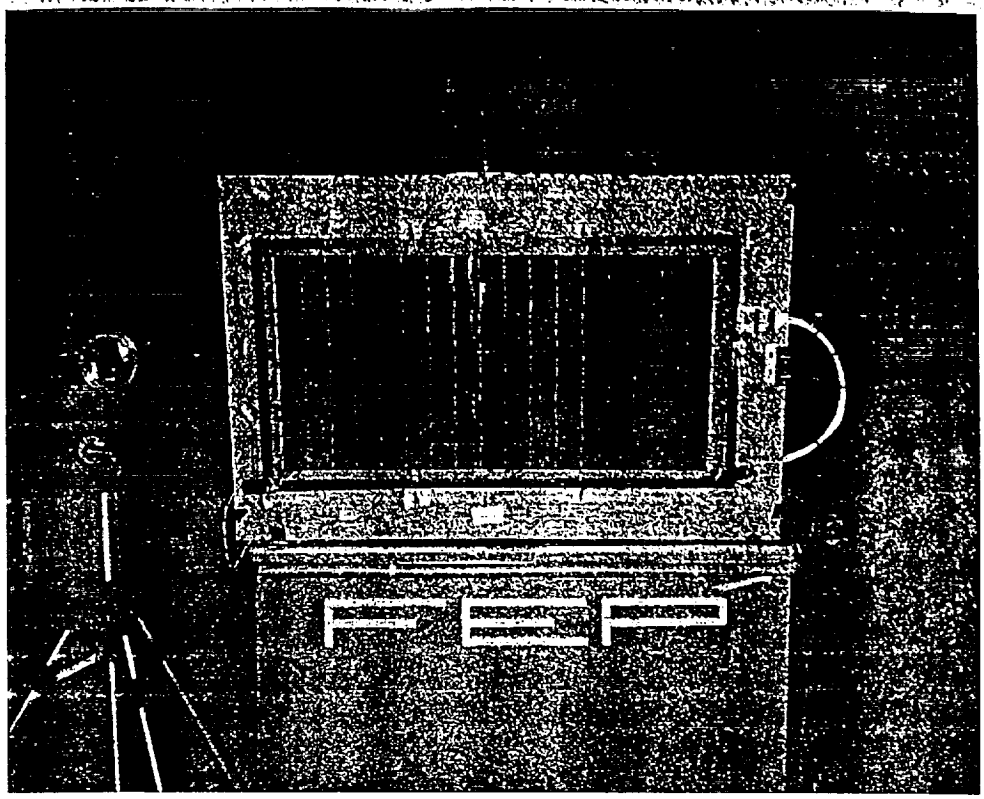


60.33	0.0002
60.2	0.0007
59.88	0.0007
59.63	0.0007
59.21	0.0009
58.97	0.001
58.62	0.0014
58.13	0.002
57.12	0.0024
56.46	0.0026
55.78	0.0029
55.22	0.003
54.68	0.003
53.64	0.0033
53.12	0.0028
51.66	0.0033
50.51	0.0035
49.15	0.0034
46.96	0.0055
44.61	0.0038
42.13	0.0058
38.34	0.0103
38.06	0.0085
38.02	0.0084
37.44	0.0107
36.99	0.011
36.75	0.011
36.29	0.0133
35.61	0.0138
35.3	0.0139
34.72	0.0166
34.09	0.0168
33.98	0.0151
33.53	0.0174
31.7	0.0221
30.95	0.0251
30.61	0.0244
30.36	0.0242
29.78	0.0256
29.23	0.0261
28.63	0.0266
28.26	0.0278
27.75	0.03
27.22	0.0318
26.72	0.0337
26.24	0.0356
25.73	0.038
21.96	0.0584
13.17	0.135
0	0.3309

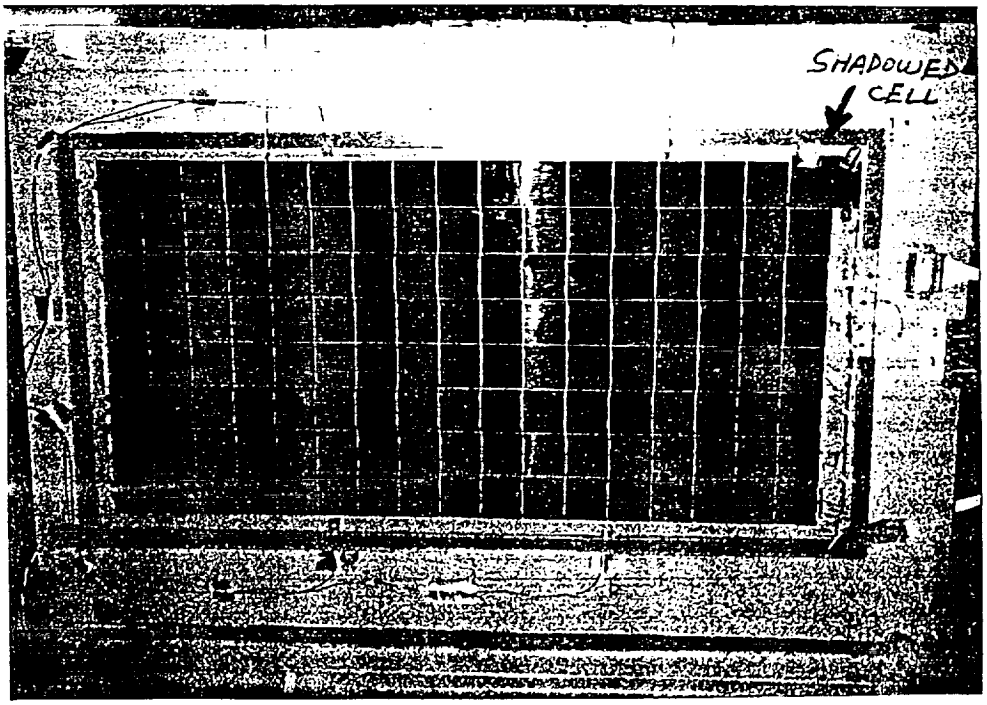

0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
AMPS
0
10
20
30
40
50
60
70
VOLTS

RT DIAGONAL SHADOW2

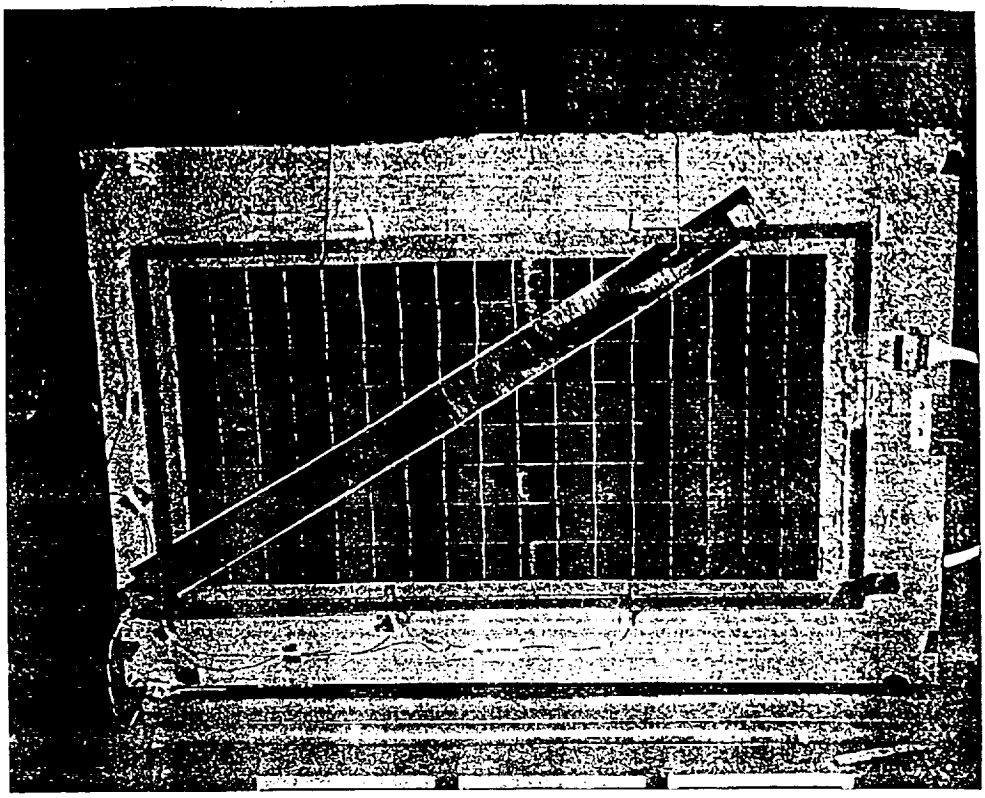
67.05	0.0002
60.41	0.0348
59.55	0.037
58.66	0.043
57.86	0.0448
56.7	0.0498
55.43	0.058
54.03	0.0668
53.3	0.0683
52.65	0.0719
52.35	0.0737
52.17	0.0752
51.98	0.0765
51.58	0.0796
51.28	0.0812
50.9	0.0822
50.67	0.0825
50.18	0.0843
49.78	0.0866
49.39	0.0896
48.96	0.0936
48.56	0.0977
47.65	0.1085
46.88	0.119
45.66	0.1352
44.47	0.1412
42.74	0.1483
40.97	0.1692
38.48	0.2046
35.27	0.2214
31.75	0.2634
31.27	0.2674
30.77	0.2689
30.25	0.2696
29.75	0.2715
29.27	0.2742
28.74	0.2774
28.27	0.2802
27.75	0.2814
27.26	0.2826
26.75	0.2848
26.28	0.2873
25.75	0.2906
13.17	0.3694
0	0.4238



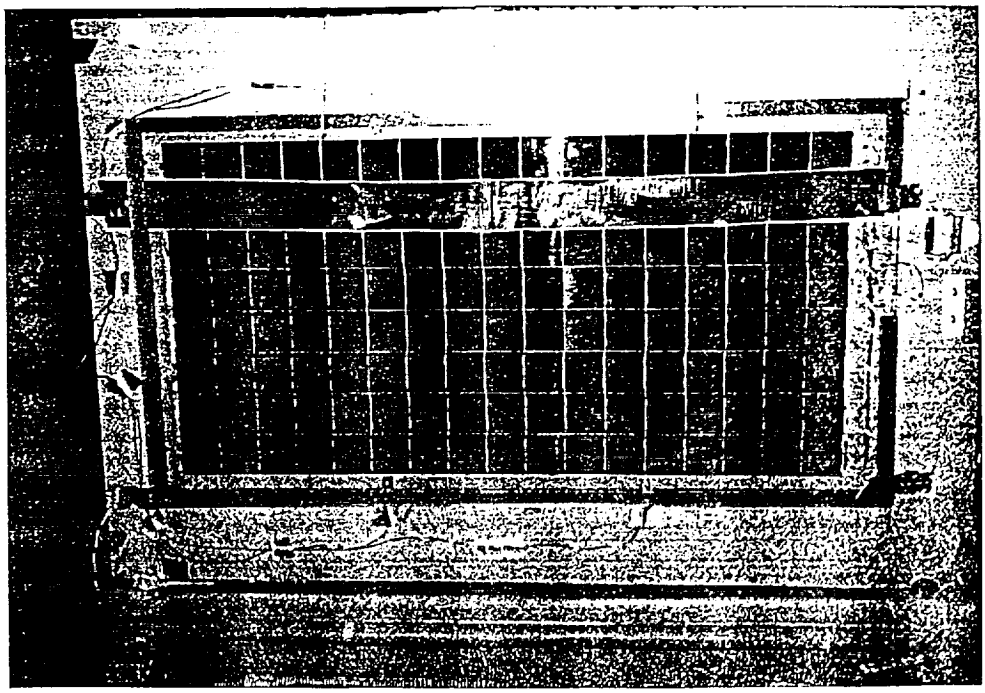
TRMM-2 MVP NO Shadow RT



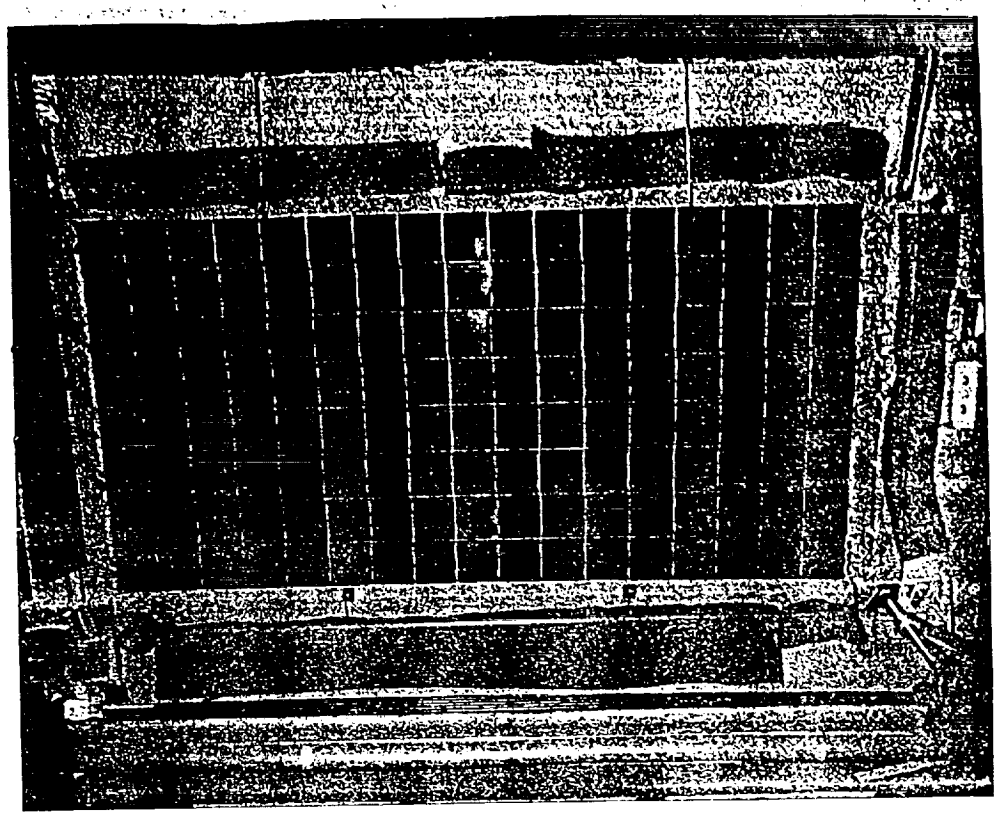
TRMM-2 MVP 1 CELL Shadowed RT



TRMM-2 NWP DIAGONAL Shadow RT

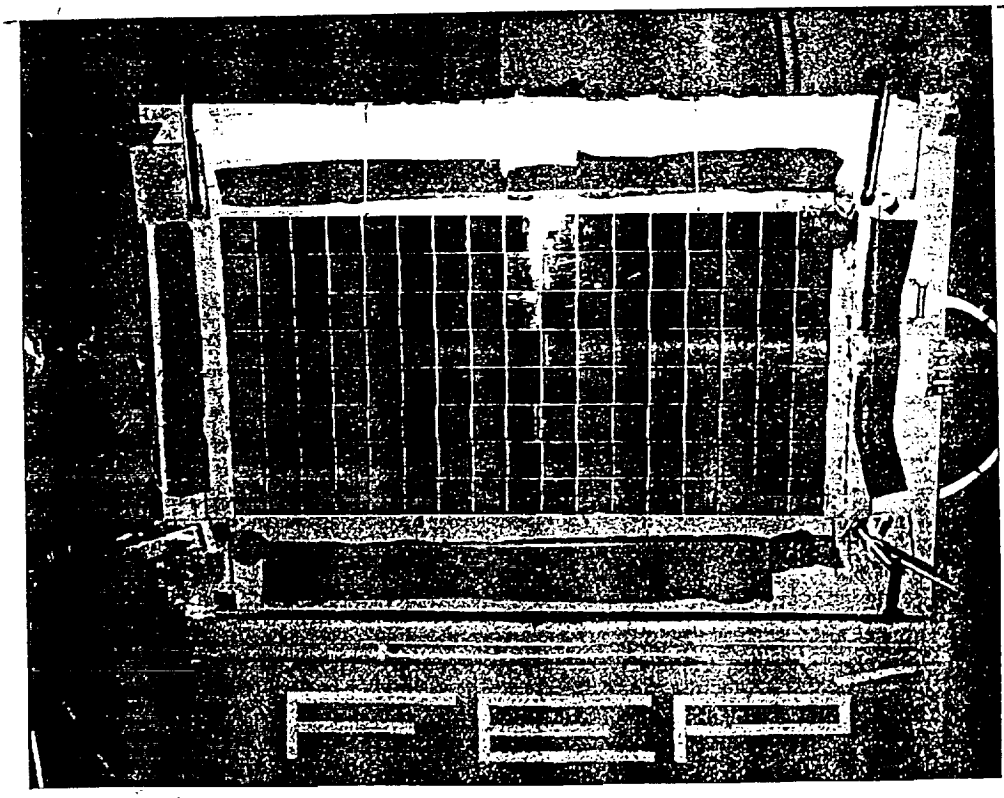


TRMM-2 NWP 1 ROW Shadowed RT



80°C

TRMM-2 MWP No Shadow



TRMM-2 MWP 1 cell shadow 80°C

Percent Change from initial readings

Part # (Lot.Cell)	Voc	Isc	Vmp	Imp	Pmp	FF	Actual V_{test}	I_{Vtest}
36.01	0.00%	-0.75%	-0.28%	-2.07%	-2.34%	-1.60%	-0.06%	-2.13%
36.02	0.43%	-0.91%	0.62%	1.58%	2.21%	2.69%	0.11%	1.85%
38.01	1.31%	-0.66%	0.13%	13.33%	13.47%	12.76%	0.17%	19.65%
38.02	-0.05%	-0.37%	-0.94%	-1.18%	-2.12%	-1.71%	0.11%	-2.19%
39.01	0.30%	-0.81%	0.49%	-1.30%	-0.81%	-0.29%	0.11%	-1.13%
39.02	0.00%	-0.63%	-1.81%	-0.45%	-2.26%	-1.64%	0.06%	-2.12%
40.01	0.10%	-0.42%	0.49%	-1.55%	-1.07%	-0.74%	-0.06%	-0.99%
40.02	-0.04%	-0.55%	0.82%	-2.31%	-1.51%	-0.92%	0.00%	-1.30%
41.01	-0.10%	-0.54%	-0.11%	-1.53%	-1.64%	-1.01%	-0.06%	-1.29%
41.02	0.23%	-0.55%	1.37%	-0.73%	0.62%	0.93%	0.00%	0.89%
42.01	0.20%	-0.56%	1.02%	-0.91%	0.10%	0.46%	0.00%	0.12%
42.02	0.15%	-0.60%	-0.39%	-0.82%	-1.21%	-0.76%	0.00%	-1.47%
44.01	0.09%	-0.66%	0.99%	-1.98%	-1.01%	-0.45%	-0.11%	-0.92%
44.02	-0.25%	-0.68%	-0.55%	-1.08%	-1.62%	-0.71%	0.11%	-1.56%
47.01	0.14%	-0.64%	0.27%	0.11%	0.37%	0.87%	0.00%	-0.08%
47.02	0.14%	-0.63%	0.50%	-2.15%	-1.67%	-1.18%	0.17%	-1.56%
Avg all	0.2%	-0.6%	0.2%	-0.2%	0.0%	0.4%	0.0%	0.4%
excluding # 38.01								
Avg	0.1%	-0.6%	0.2%	-1.1%	-0.9%	-0.4%	0.0%	-0.9%
Minimum	-0.2%	-0.9%	-1.8%	-2.3%	-2.3%	-1.7%	-0.1%	-2.2%
Maximum	0.4%	-0.4%	1.4%	1.6%	2.2%	2.7%	0.2%	1.8%

Adjustment*

Isc	Imp	I_{Vtest}
-0.1%	-1.4%	-1.5%
-0.3%	2.2%	2.5%
0.0%	14.1%	20.4%
0.3%	-0.5%	-1.5%
-0.2%	-0.7%	-0.5%
0.0%	0.2%	-1.5%
0.2%	-0.9%	-0.3%
0.1%	-1.7%	-0.7%
0.1%	-0.9%	-0.6%
0.1%	-0.1%	1.5%
0.1%	-0.3%	0.8%
0.1%	-0.2%	-0.8%
0.0%	-1.3%	-0.3%
0.0%	-0.4%	-0.9%
0.0%	0.8%	0.6%
0.0%	-1.5%	-0.9%
0.0%	0.5%	1.0%
0.0%	-0.4%	-0.3%
-0.3%	-1.7%	-1.5%
0.3%	2.2%	2.5%

*Adjustment made for uniformity of light source on block

Cells meet requirement 4.10.1 for Humidity exposure and no more than 1.5% loss for any cell after exposure

Initial output of Humidity Test Cells

Part # (Lot.Cell)	Voc (Volts)	Isc (Amperes)	Vmp (Volts)	Imp (Amperes)	Pmp (Watts)	FF	Actual V_{test} (Volts)	I_{Vtest} (Amperes)	Adjustment* Isc (Amperes)	Adjustment* Imp (Amperes)	Adjustment* I_{Vtest} (Amperes)
36.01	1.0176	0.54221	0.88428	0.50558	0.44709	0.81033	0.87012	0.51208	0.54221	0.50558	0.51208
36.02	1.0146	0.54925	0.86963	0.49226	0.42808	0.76814	0.86963	0.49226	0.54925	0.49226	0.49226
38.01	0.96777	0.53541	0.75146	0.27121	0.20381	0.39333	0.87012	0.20625	0.53541	0.27121	0.20625
38.02	1.0127	0.547	0.88086	0.5055	0.44532	0.80391	0.86963	0.51099	0.547	0.5055	0.51099
39.01	1.0156	0.54495	0.88818	0.50454	0.44812	0.80967	0.86963	0.51387	0.54495	0.50454	0.51387
39.02	1.0215	0.53933	0.88818	0.49589	0.44045	0.79948	0.86963	0.50474	0.53933	0.49589	0.50474
40.01	1.0249	0.53498	0.89697	0.50017	0.44864	0.81824	0.87061	0.51116	0.53498	0.50017	0.51116
40.02	1.0273	0.53532	0.89551	0.50007	0.44782	0.81428	0.86963	0.5099	0.53532	0.50007	0.5099
41.01	1.0244	0.54751	0.8877	0.50907	0.4519	0.80569	0.87109	0.5163	0.54751	0.50907	0.5163
41.02	1.0254	0.54053	0.85791	0.47864	0.41066	0.74092	0.86963	0.47097	0.54053	0.47864	0.47097
42.01	1.0107	0.54558	0.86572	0.50497	0.43716	0.79277	0.86963	0.5019	0.54558	0.50497	0.5019
42.02	1.0107	0.5484	0.87012	0.51433	0.44753	0.80738	0.87012	0.51433	0.5484	0.51433	0.51433
44.01	1.0264	0.54154	0.88477	0.50895	0.4503	0.81017	0.87061	0.51452	0.54154	0.50895	0.51452
44.02	1.0176	0.54879	0.88672	0.5128	0.45471	0.81425	0.86963	0.51978	0.54879	0.5128	0.51978
47.01	1.0215	0.53793	0.89258	0.50055	0.44683	0.81317	0.87061	0.51029	0.53793	0.50055	0.51029
47.02	1.0347	0.54082	0.8833	0.51316	0.45328	0.81005	0.86963	0.51687	0.54082	0.51316	0.51687
AVERAGE	1.017086	0.542472	0.873993	0.488606	0.428856	0.775736	0.8699969	0.489138	0.542472	0.488606	0.489138
STND DEV	0.014287	0.004859	0.033373	0.056796	0.059073	0.100604	0.000473	0.073941	0.004859	0.056796	0.073941

*Adjustment made for uniformity of light source on block

Final Output of Humidity Test Cells

Part # (Lot.Cell)	Voc (Volts)	Isc (Amperes)	Vmp (Volts)	Imp (Amperes)	Pmp (Watts)	FF	Actual V_{test} (Volts)	I_{Vtest} (Amperes)	Adjustment* Isc (Amperes)	Adjustment* Imp (Amperes)	Adjustment* I_{Vtest} (Amperes)
36.01	1.0176	0.53814	0.88184	0.49512	0.43664	0.79737	0.86963	0.50119	0.541681	0.4983776	0.504488
36.02	1.019	0.54427	0.875	0.50003	0.43752	0.78884	0.87061	0.50136	0.547851	0.5033199	0.504659
38.01	0.98047	0.53186	0.75244	0.30736	0.23127	0.4435	0.87158	0.24677	0.535359	0.3093823	0.248394
38.02	1.0122	0.54498	0.87256	0.49954	0.43589	0.79017	0.87061	0.49981	0.548566	0.5028267	0.503098
39.01	1.0186	0.54055	0.89256	0.49797	0.44448	0.8073	0.87061	0.50805	0.544107	0.5012464	0.511393
39.02	1.0215	0.53595	0.87207	0.49366	0.43051	0.78638	0.87012	0.49406	0.539476	0.496908	0.497311
40.01	1.0259	0.53272	0.90137	0.49242	0.44385	0.81217	0.87012	0.50611	0.536225	0.4956599	0.50944
40.02	1.0269	0.53236	0.90283	0.4885	0.44104	0.80679	0.86963	0.50325	0.535863	0.4917141	0.506561
41.01	1.0234	0.54456	0.88672	0.50126	0.44451	0.79758	0.87061	0.50965	0.548143	0.504558	0.513003
41.02	1.0278	0.53758	0.86963	0.47514	0.41319	0.7478	0.86963	0.47514	0.541117	0.4782662	0.478266
42.01	1.0127	0.54255	0.87451	0.50039	0.4376	0.79645	0.86963	0.50252	0.54612	0.5036823	0.505826
42.02	1.0122	0.54512	0.8667	0.5101	0.4421	0.80124	0.87012	0.50676	0.548707	0.5134562	0.510094
44.01	1.0273	0.53799	0.89355	0.49887	0.44577	0.80652	0.86963	0.5098	0.54153	0.5021523	0.513154
44.02	1.0151	0.54507	0.88184	0.50728	0.44734	0.80846	0.87061	0.51169	0.548656	0.5106176	0.515057
47.01	1.0229	0.5345	0.89502	0.50108	0.44848	0.82024	0.87061	0.50986	0.538017	0.5043768	0.513215
47.02	1.0361	0.53739	0.8877	0.50212	0.44573	0.80052	0.87109	0.50883	0.540926	0.5054237	0.512178
AVERAGE	1.018729	0.539099	0.875396	0.485678	0.42662	0.775708	0.8703025	0.487178	0.542646	0.488873	0.490383
STND DEV	0.011786	0.004704	0.033584	0.046682	0.051116	0.087171	0.000569	0.062658	0.004735	0.0469894	0.063071

*Adjustment made for uniformity of light source on block

Absolute change in output ( ) = loss

Part # (Lot.Cell)	Voc (Volts)	Isc (Amperes)	Vmp (Volts)	Imp (Amperes)	Pmp (Watts)	FF	Actual V_{test} (Volts)	I_{Vtest} (Amperes)	Adjustment* Isc (Amperes)	Adjustment* Imp (Amperes)	Adjustment* I_{Vtest} (Amperes)
36.01	0.	(0.00407)	(0.00244)	(0.01046)	(0.01045)	(0.01296)	(0.00049)	(0.01089)	(0.00053)	(0.0072)	(0.00759)
36.02	0.0044	(0.00498)	0.00537	0.00777	0.00944	0.0207	0.00098	0.0091	(0.0014)	0.01106	0.0124
38.01	0.0127	(0.00355)	0.00098	0.03615	0.02746	0.05017	0.00146	0.04052	(0.00005)	0.03817	0.04214
38.02	(0.0005)	(0.00202)	(0.0083)	(0.00596)	(0.00943)	(0.01374)	0.00098	(0.01118)	0.00157	(0.00267)	(0.00789)
39.01	0.003	(0.0044)	0.00438	(0.00657)	(0.00364)	(0.00237)	0.00098	(0.00582)	(0.00084)	(0.00329)	(0.00248)
39.02	0.	(0.00338)	(0.01611)	(0.00223)	(0.00994)	(0.0131)	0.00049	(0.01068)	0.00015	0.00102	(0.00743)
40.01	0.001	(0.00226)	0.0044	(0.00775)	(0.00479)	(0.00607)	(0.00049)	(0.00505)	0.00125	(0.00451)	(0.00172)
40.02	(0.0004)	(0.00296)	0.00732	(0.01157)	(0.00678)	(0.00749)	0.	(0.00665)	0.00054	(0.00836)	(0.00334)
41.01	(0.001)	(0.00295)	(0.00098)	(0.00781)	(0.00739)	(0.00811)	(0.00048)	(0.00665)	0.00063	(0.00451)	(0.0033)
41.02	0.0024	(0.00295)	0.01172	(0.0035)	0.00253	0.00688	0.	0.00417	0.00059	(0.00037)	0.0073
42.01	0.002	(0.00303)	0.00879	(0.00458)	0.00044	0.00368	0.	0.00062	0.00054	(0.00129)	0.00393
42.02	0.0015	(0.00328)	(0.00342)	(0.00423)	(0.00543)	(0.00614)	0.	(0.00757)	0.00031	(0.00087)	(0.00424)
44.01	0.0009	(0.00355)	0.00878	(0.01008)	(0.00453)	(0.00365)	(0.00098)	(0.00472)	(0.00001)	(0.0068)	(0.00137)
44.02	(0.0025)	(0.00372)	(0.00488)	(0.00552)	(0.00737)	(0.00579)	0.00098	(0.00809)	(0.00013)	(0.00218)	(0.00472)
47.01	0.0014	(0.00343)	0.00244	0.00053	0.00165	0.00707	0.	(0.00043)	0.00009	0.00383	0.00292
47.02	0.0014	(0.00343)	0.0044	(0.01104)	(0.00755)	(0.00953)	0.00146	(0.00804)	0.00011	(0.00774)	(0.00469)
AVERAGE	0.00164	(0.00337)	0.0014	(0.00293)	(0.00224)	(0.00003)	0.00031	(0.00196)	0.00017	0.00027	0.00125
STND DEV	0.00328	0.00071	0.00697	0.01113	0.00924	0.01566	0.00073	0.01224	0.0007	0.01086	0.01187

*Adjustment made for uniformity of light source on block

SEQ	BT1	BT2	BT3	BT4	BT5	BT6	BT7	BT8	BT9	BT10	BT11	BT12	BT13	BT14	BT15	BT16	BT17	BT18	BT19	BT20
1 l pmax	0.5046	0.5002	0.4965	0.5087	0.5058	0.4455	0.5090	0.4993	0.5035	0.4991	0.5134	0.5120	0.5129	0.5092	0.4980	0.5050	0.5018	0.5076	0.5085	0.5041
1 Vpmax	0.8493	0.8421	0.8355	0.8422	0.8550	0.8102	0.8351	0.8489	0.8419	0.8348	0.8490	0.8493	0.8352	0.8352	0.8421	0.8422	0.8421	0.8349	0.8349	0.8422
1 Pmax	0.4286	0.4212	0.4148	0.4284	0.4325	0.3609	0.4251	0.4239	0.4239	0.4166	0.4359	0.4348	0.4284	0.4253	0.4194	0.4253	0.4226	0.4238	0.4245	0.4246
2b l pmax	0.5015	0.5041	0.4924	0.5076	0.5053	0.4425	0.5027	0.4954	0.5022	0.4976	0.5148	0.5044	0.5075	0.5083	0.4970	0.5000	0.5063	0.5038	0.5079	0.5079
2b Vpmax	0.8549	0.8350	0.8349	0.8422	0.8551	0.7750	0.8419	0.8550	0.8421	0.8352	0.8423	0.8600	0.8423	0.8350	0.8423	0.8492	0.8351	0.8349	0.8347	0.8349
2b Pmax	0.4287	0.4209	0.4111	0.4275	0.4321	0.3429	0.4232	0.4236	0.4229	0.4156	0.4336	0.4338	0.4275	0.4244	0.4186	0.4246	0.4228	0.4206	0.4239	0.4240
2b delta%	0.0410	-0.0701	-0.9051	-0.2167	-0.0872	-5.2507	-0.4354	-0.0682	-0.2350	-0.2534	-0.5213	-0.2438	-0.2121	-0.2011	-0.1774	-0.1675	0.0580	-0.7543	-0.1421	-0.1196
2d l pmax	0.4977	0.5036	0.4932	0.5018	0.5057	0.4428	0.5048	0.5001	0.4994	0.4998	0.5173	0.5094	0.5050	0.5095	0.5019	0.5057	0.5076	0.5010	0.5041	0.5092
2d Vpmax	0.8649	0.8421	0.8352	0.8548	0.8549	0.7934	0.8422	0.8488	0.8489	0.8350	0.8421	0.8551	0.8489	0.8350	0.8353	0.8421	0.8350	0.8422	0.8422	0.8350
2d Pmax	0.4305	0.4241	0.4119	0.4289	0.4323	0.3513	0.4251	0.4245	0.4239	0.4173	0.4356	0.4356	0.4287	0.4254	0.4192	0.4258	0.4238	0.4219	0.4246	0.4252
2d delta%	0.4423	0.6751	-0.7053	0.1192	-0.0315	-2.7401	0.0180	0.1482	0.0104	0.1640	-0.0593	0.1713	0.0747	0.0349	-0.0307	0.1266	0.3020	-0.4392	0.0015	0.1479
2f l pmax	0.5023	0.4933	0.4934	0.5025	0.5099	0.4201	0.5092	0.5040	0.5077	0.4963	0.5165	0.5125	0.5118	0.5048	0.5018	0.5010	0.5018	0.4960	0.5042	0.5085
2f Vpmax	0.8549	0.8500	0.8349	0.8550	0.8488	0.7931	0.8354	0.8420	0.8351	0.8423	0.8424	0.8493	0.8352	0.8422	0.8353	0.8493	0.8421	0.8493	0.8421	0.8354
2f Pmax	0.4294	0.4193	0.4119	0.4296	0.4328	0.3332	0.4254	0.4244	0.4240	0.4180	0.4351	0.4353	0.4275	0.4251	0.4192	0.4255	0.4226	0.4213	0.4246	0.4248
2f delta%	0.2002	-0.4563	-0.7006	0.2817	0.0795	-8.3326	0.0752	0.1207	0.0197	0.3313	-0.1786	0.0976	-0.2149	-0.0332	-0.0506	0.0443	0.0000	-0.6035	0.0095	0.0584
2h l pmax	0.4960	0.4988	0.5013	0.5055	0.5109	0.4992	0.5081	0.5006	0.5039	0.4921	0.5099	0.5084	0.5045	0.5107	0.5006	0.4982	0.5073	0.5064	0.5052	0.5070
2h Vpmax	0.8599	0.8418	0.8222	0.8491	0.8491	0.8492	0.8353	0.8491	0.8419	0.8491	0.8489	0.8549	0.8492	0.8353	0.8421	0.8492	0.8347	0.8347	0.8421	0.8421
2h Pmax	0.4265	0.4199	0.4122	0.4292	0.4338	0.4239	0.4244	0.4251	0.4242	0.4178	0.4329	0.4346	0.4284	0.4266	0.4216	0.4231	0.4234	0.4227	0.4254	0.4269
2h delta%	-0.4798	-0.3164	-0.6446	0.1847	0.3103	14.8557	-0.1531	0.2832	0.0794	0.2856	-0.6983	-0.0484	0.0110	0.3057	0.5194	-0.5294	0.2072	-0.2610	0.2074	0.5602
2j l pmax	0.4991	0.4936	0.4930	0.5037	0.5081	0.4991	0.5036	0.5015	0.5093	0.5012	0.5099	0.5080	0.5092	0.5102	0.4997	0.4989	0.5064	0.5022	0.5057	0.5198
2j Vpmax	0.8549	0.8491	0.8353	0.8548	0.8548	0.8492	0.8416	0.8489	0.8350	0.8350	0.8493	0.8548	0.8418	0.8351	0.8419	0.8493	0.8349	0.8423	0.8422	0.8221
2j Pmax	0.4267	0.4191	0.4118	0.4306	0.4343	0.4238	0.4238	0.4257	0.4253	0.4185	0.4331	0.4342	0.4286	0.4261	0.4207	0.4237	0.4228	0.4230	0.4259	0.4273
2j delta%	-0.4397	-0.5017	-0.7341	0.4960	0.4294	14.8387	-0.2917	0.4387	0.3219	0.4428	-0.6508	-0.1389	0.0631	0.1841	0.3165	-0.3765	0.0538	-0.1873	0.3179	0.6493
2l l pmax	0.4997	0.4971	0.4944	0.5118	0.5118	0.5001	0.5097	0.5014	0.5104	0.4935	0.5107	0.5126	0.5062	0.5109	0.5050	0.5031	0.5067	0.4980	0.5063	0.5115
2l Vpmax	0.8598	0.8489	0.8352	0.8418	0.8491	0.8492	0.8351	0.8492	0.8352	0.8491	0.8492	0.8492	0.8491	0.8351	0.8352	0.8419	0.8353	0.8493	0.8420	0.8353
2l Pmax	0.4296	0.4220	0.4129	0.4308	0.4346	0.4247	0.4257	0.4258	0.4263	0.4190	0.4337	0.4353	0.4298	0.4267	0.4218	0.4236	0.4232	0.4230	0.4263	0.4273
2l delta%	0.2526	0.1824	-0.4608	0.5585	0.4856	15.0090	0.1373	0.4540	0.5605	0.5685	-0.5050	0.1053	0.3351	0.3208	0.5714	-0.4134	0.1608	-0.1995	0.4124	0.6326
2n l pmax	0.5037	0.4937	0.4918	0.5032	0.5097	0.5043	0.5085	0.5010	0.4999	0.4985	0.5104	0.5122	0.5019	0.5057	0.4963	0.5037	0.4984	0.5072	0.5099	0.5110
2n Vpmax	0.8489	0.8492	0.8350	0.8552	0.8492	0.8420	0.8348	0.8493	0.8490	0.8418	0.8490	0.8490	0.8553	0.8424	0.8489	0.8419	0.8492	0.8352	0.8351	0.8352
2n Pmax	0.4276	0.4193	0.4107	0.4303	0.4328	0.4246	0.4245	0.4255	0.4244	0.4196	0.4333	0.4349	0.4293	0.4260	0.4213	0.4241	0.4232	0.4236	0.4258	0.4268
2n delta%	-0.2259	-0.4695	-1.0161	0.4437	0.0874	14.9961	-0.1343	0.3863	0.1222	0.7122	-0.5878	0.0037	0.2099	0.1685	0.4612	-0.2938	0.1596	-0.0429	0.2984	0.5235
2p l pmax	0.5036	0.4956	0.4843	0.5075	0.5154	0.5095	0.5050	0.5013	0.5052	0.4983	0.5163	0.5091	0.5052	0.5101	0.5010	0.5031	0.5066	0.5014	0.5060	0.5195
2p Vpmax	0.8490	0.8491	0.8492	0.8491	0.8420	0.8353	0.8420	0.8488	0.8423	0.8424	0.8422	0.8548	0.8493	0.8352	0.8420	0.8424	0.8351	0.8421	0.8420	0.8224
2p Pmax	0.4276	0.4208	0.4113	0.4309	0.4340	0.4256	0.4252	0.4255	0.4255	0.4198	0.4348	0.4352	0.4291	0.4260	0.4218	0.4238	0.4231	0.4222	0.4261	0.4272
2p delta%	-0.2340	-0.0961	-0.8652	0.5781	0.3474	15.1888	0.0339	0.3872	0.3838	0.7431	-0.2412	0.0775	0.1613	0.1764	0.5870	-0.3538	0.1172	-0.3710	0.3533	0.6282
2r l pmax	0.5104	0.4930	0.4904	0.5076	0.5071	0.5000	0.5088	0.5047	0.5051	0.4932	0.5103	0.5118	0.5041	0.5098	0.5007	0.5033	0.5077	0.5023	0.5095	0.5114
2r Vpmax	0.8351	0.8491	0.8348	0.8492	0.8548	0.8487	0.8351	0.8424	0.8422	0.8488	0.8490	0.8490	0.8489	0.8349	0.8421	0.8422	0.8349	0.8422	0.8349	0.8349
2r Pmax	0.4262	0.4186	0.4094	0.4311	0.4335	0.4244	0.4249	0.4252	0.4254	0.4186	0.4332	0.4345	0.4279	0.4256	0.4216	0.4239	0.4239	0.4230	0.4254	0.4270
2r delta%	-0.5447	-0.6240	-1.3288	0.6094	0.2330	14.9419	-0.0393	0.3066	0.3523	0.4728	-0.6075	-0.0744	-0.1037	0.0818	0.5392	-0.3378	0.3097	-0.1792	0.1963	0.5656
2t l pmax	0.5035	0.4970	0.4911	0.5149	0.5114	0.5050	0.5168	0.5050	0.5047	0.5017	0.5153	0.5084	0.5095	0.5111	0.5007	0.5027	0.5072	0.5025	0.5101	0.5110
2t Vpmax	0.8490	0.8419	0.8351	0.8349	0.8489	0.8419	0.8223	0.8418	0.8418	0.8348	0.8421	0.8551	0.8421	0.8349	0.8421	0.8418	0.8351	0.8419	0.8351	0.8351
2t Pmax	0.4275	0.4184	0.4101	0.4299	0.4341	0.4252	0.4250	0.4251	0.4249	0.4188	0.4339	0.4347	0.4290	0.4267	0.4216	0.4232	0.4236	0.4231	0.4260	0.4267
2t delta%	-0.2539	-0.6678	-1.1480	0.3403	0.3843	15.1038	-0.0238	0.2948	0.2259	0.5182	-0.4476	-0.0250	0.1575	0.3359	0.5392	-0.5053	0.2354	-0.1750	0.3375	0.5116
3b l pmax	0.5031	0.4974	0.4972	0.5023	0.5072	0.5110	0.5098	0.5050	0.5086	0.4961	0.5184	0.5067	0.5090	0.5070	0.4983	0.5097	0.5084	0.5011	0.4985	0.5093
3b Vpmax	0.8490	0.8419	0.8219	0.8550	0.8492	0.8350	0.8351	0.8422	0.8351	0.8422	0.8418	0.8418	0.8419	0.8349	0.8418	0.8348	0.8348	0.8421	0.8488	0.8348
3b Pmax	0.4271	0.4188	0.4086	0.4295	0.4307	0.4267	0.4257	0.4253	0.4247	0.4178	0.4364	0.4265	0.4285	0.4233	0.4195	0.4255	0.4244	0.4220	0.4231	0.4252
3b delta%	-0.3336	-0.5868	-1.5116	0.2420	-0.4051	15.4074	0.1569	0.3422	0.1966	0.2792	0.1174	-1.9463	0.0357	-0.4700	0.0246	0.0438	0.4351	-0.4311	-0.3356	0.1436
3d l pmax	0.5039	0.4930	0.4878	0.5062	0.5114	0.5061	0.5094	0.5004	0.4987	0.4968	0.5135	0.5070	0.5081	0.5142	0.5019	0.5012	0.5075	0.5045	0.5067	0.5097
3d Vpmax	0.8489	0.8490	0.8351	0.8491	0.8422	0.8421	0.8349	0.8491	0.8491	0.8423	0.8489	0.8419	0.8421	0.8218	0.8352	0.8488	0.8349	0.8349	0.8349	0.8349
3d Pmax	0.4278	0.4186	0.4074	0.4298	0.4307	0.4262	0.4253	0.4249	0.4234	0.4185	0.4359	0.4268	0.4279	0.4226	0.4192	0.4254	0.4237	0.4212	0.4230	0.4255
3d delta%	-0.1861	-0.6359	-1.8323	0.3228	-0.4082	15.3085	0.0546	0.2433	-0.1064	0.4316	0.0077	-1.8738	-0.1176	-0.6423	-0.0427	0.0253	0.2705	-0.6265	-0.3673	0.2339
3f l pmax	0.5029	0.5013	0.4900	0.5050	0.5037	0.5062	0.5084	0.4966	0.5022	0.4963	0.5168	0.5064	0.5036	0.5149	0.4980	0.5053	0.5076	0.5003	0.5067	0.5108
3f Vpmax	0.8491	0.8352	0.8352	0.8489	0.8551	0.8423	0.8349	0.8549	0.8422	0.8422	0.8420	0.8420	0.8492	0.8218	0.8422	0.8420	0.8347	0.8417	0.8351	0.8347
3f Pmax	0.4270	0.4187	0.4092	0.4287	0.4307	0.4264	0.4245	0.4245	0.4230	0.4180	0.4351	0.4264	0.4277	0.4231	0.4194	0.4255	0.4237	0.4211	0.4231	0.4264
3f delta%	-0.3617	-0.6049	-1.3629	0.0624	-0.4052	15.3453	-0.1420	0.1620	-0.2231	0.3194	-0.1680	-1.9824	-0.1676	-0.5055	0.0119	0.0356	0.2662	-0.6394	-0.3312	0.4249
3h l pmax	0.5024	0.5012	0.4909	0.5048	0.5111	0.5097	0.5103	0.5041	0.4961	0.4996	0.5172	0.5091	0.5060	0.5105	0.4979	0.5010	0.4990	0.4966	0.5069	0.5157
3h Vpmax	0.8490	0.8349	0.8223	0.8420	0.8353	0.8218	0.8218	0.8353	0.8489	0.8220	0.8349	0.8351	0.8350	0.8220	0.8349	0.8423	0.8422	0.8350	0.8101	0.8220
3h Pmax	0.4265	0.4185	0.4037	0.4250	0.4269	0.4189	0.4194	0.4211	0.4211	0.4107	0.4318	0.4251	0.4225	0.4196	0.4157	0.4220	0.4203	0.4147	0.4106	0.4239
3h delta%	-0.4734	-0.6611	-2.7643	-0.7965	-1.2970	13.8294	-1.3595	-0.6605	-0.6547	-1.4555	-0.9417	-2.2797	-1.3879	-1.3471	-0.8826	-0.7864	-0.5492	-2.2028	-3.3867	-0.1528

SEQ	BT1	BT2	BT3	BT4	BT5	BT6	BT7	BT8	BT9	BT10	BT11	BT12	BT13	BT14	BT15	BT16	BT17	BT18	BT19	BT20
4b I pmax	0.5018	0.5001	0.4925	0.5034	0.5082	0.5111	0.5143	0.4991	0.5062	0.4984	0.5227	0.5137	0.5041	0.5121	0.4961	0.5090	0.5113	0.5076	0.5061	0.5121
4b Vpmax	0.8490	0.8348	0.8218	0.8349	0.8348	0.8218	0.8099	0.8422	0.8350	0.8221	0.8219	0.8222	0.8351	0.8103	0.8220	0.8222	0.8218	0.8218	0.8100	0.8218
4b Pmax	0.4260	0.4175	0.4047	0.4203	0.4242	0.4200	0.4165	0.4203	0.4227	0.4097	0.4296	0.4224	0.4210	0.4150	0.4078	0.4185	0.4202	0.4171	0.4099	0.4208
4b delta%	-0.5935	-0.8946	-2.4928	-1.9364	-1.9361	14.0654	-2.0489	-0.8359	-0.2886	-1.6874	-1.4593	-2.9542	-1.7579	-2.4892	-2.8376	-1.6275	-0.5663	-1.5941	-3.5629	-0.8814
4d I pmax	0.5084	0.4978	0.4981	0.5061	0.5064	0.5042	0.5070	0.5009	0.5019	0.4937	0.5002	0.5089	0.5010	0.5106	0.4981	0.5073	0.4993	0.5016	0.5113	0.5158
4d Vpmax	0.8222	0.8354	0.8099	0.8101	0.8349	0.8220	0.8102	0.8219	0.8352	0.8220	0.8099	0.8099	0.8220	0.7927	0.7931	0.8222	0.8352	0.8220	0.7930	0.8100
4d Pmax	0.4180	0.4159	0.4034	0.4100	0.4228	0.4145	0.4108	0.4117	0.4192	0.4058	0.4051	0.4122	0.4118	0.4048	0.3950	0.4171	0.4170	0.4123	0.4055	0.4178
4d delta%	-2.5240	-1.2880	-2.8295	-4.4966	-2.2861	12.9106	-3.4799	-2.9552	-1.1235	-2.6680	-7.5941	-5.5036	-4.0192	-5.0725	-6.1570	-1.9681	-1.3310	-2.7843	-4.7072	-1.6168
4f I pmax	0.5094	0.5049	0.4944	0.5104	0.5127	0.5187	0.5136	0.5079	0.5094	0.5091	0.4998	0.5189	0.5082	0.5186	0.5043	0.5141	0.5159	0.5095	0.5072	0.5243
4f Vpmax	0.8353	0.8353	0.8222	0.8103	0.8355	0.8100	0.8103	0.8222	0.8223	0.8099	0.8223	0.8100	0.8224	0.7930	0.7930	0.8221	0.8220	0.8220	0.8100	0.8100
4f Pmax	0.4255	0.4217	0.4065	0.4136	0.4284	0.4201	0.4162	0.4176	0.4189	0.4123	0.4110	0.4203	0.4179	0.4112	0.3999	0.4226	0.4241	0.4188	0.4108	0.4247
4f delta%	-0.7180	0.1244	-2.0492	-3.5906	-0.9567	14.0910	-2.1375	-1.4992	-1.1977	-1.0498	-6.0564	-3.4576	-2.4956	-3.4125	-4.8651	-0.6316	0.3547	-1.1906	-3.3383	0.0306
4h I pmax	0.4970	0.4933	0.4914	0.4958	0.4976	0.5051	0.4992	0.4928	0.4995	0.4964	0.4940	0.5053	0.5012	0.5065	0.4885	0.5017	0.5016	0.4998	0.5032	0.5030
4hVpmax	0.8351	0.8349	0.8101	0.8101	0.8352	0.8100	0.8103	0.8219	0.8223	0.8102	0.8103	0.8100	0.8099	0.7932	0.7929	0.8220	0.8220	0.8101	0.7930	0.8221
4h Pmax	0.4150	0.4119	0.3981	0.4016	0.4156	0.4091	0.4045	0.4050	0.4107	0.4022	0.4003	0.4093	0.4059	0.4018	0.3873	0.4124	0.4123	0.4049	0.3990	0.4135
4h delta%	-3.2556	-2.2732	-4.2058	-6.6674	-4.0577	11.7779	-5.0838	-4.6474	-3.2034	-3.5967	-8.8907	-6.2421	-5.5312	-5.8563	-8.2705	-3.1313	-2.4861	-4.6698	-6.3926	-2.6690

SEQ	BT1	BT2	BT3	BT4	BT5	BT6	BT7	BT8	BT9	BT10	BT11	BT12	BT13	BT14	BT15	BT16	BT17	BT18	BT19	BT20
1 I 0.86v	0.4977	0.4881	0.4789	0.4973	0.5019	0.4075	0.4897	0.4922	0.4902	0.4815	0.5054	0.5052	0.4964	0.4896	0.4859	0.4923	0.4880	0.4898	0.4887	0.4881
2b I 0.86v	0.4977	0.4870	0.4734	0.4962	0.5010	0.3640	0.4888	0.4915	0.4891	0.4803	0.5018	0.5044	0.4957	0.4882	0.4856	0.4920	0.4877	0.4864	0.4890	0.4884
2b delta %	0.0000	-0.2259	-1.1618	-0.2217	-0.1796	-11.9505	-0.1841	-0.1424	-0.2249	-0.2498	-0.7174	-0.1586	-0.1412	-0.2868	-0.0618	-0.0610	-0.0615	-0.6990	0.0613	0.0614
2d I 0.86v	0.5004	0.4915	0.4757	0.4982	0.5022	0.3891	0.4916	0.4931	0.4921	0.4829	0.5057	0.5053	0.4971	0.4896	0.4856	0.4932	0.4895	0.4886	0.4907	0.4902
2d delta %	0.5396	0.6918	-0.6727	0.1807	0.0597	-4.7289	0.3865	0.1825	0.3861	0.2899	0.0593	0.0198	0.1408	0.0000	-0.0618	0.1825	0.3064	-0.2456	0.4076	0.4284
2f I 0.86v	0.4988	0.4896	0.4755	0.4989	0.5029	0.3577	0.4905	0.4928	0.4907	0.4834	0.5051	0.5057	0.4967	0.4894	0.4866	0.4932	0.4893	0.4871	0.4898	0.4891
2f delta %	0.2205	0.3064	-0.7150	0.3207	0.1988	-13.9223	0.1631	0.1218	0.1019	0.3930	-0.0594	0.0989	0.0604	-0.0409	0.1439	0.1825	0.2657	-0.5543	0.2246	0.2045
2h I 0.86v	0.4960	0.4861	0.4762	0.4990	0.5043	0.4912	0.4900	0.4941	0.4914	0.4836	0.5024	0.5040	0.4967	0.4913	0.4886	0.4899	0.4896	0.4893	0.4908	0.4917
2h delta %	-0.3427	-0.4114	-0.5670	0.3407	0.4759	17.0399	0.0612	0.3845	0.2442	0.4342	-0.5971	-0.2381	0.0604	0.3460	0.5526	-0.4899	0.3268	-0.1022	0.4279	0.7322
2j I 0.86v	0.4959	0.4860	0.4749	0.5005	0.5038	0.4907	0.4896	0.4945	0.4923	0.4846	0.5022	0.5044	0.4977	0.4906	0.4881	0.4910	0.4897	0.4898	0.4919	0.4936
2j delta %	-0.3630	-0.4321	-0.8423	0.6394	0.3771	16.9554	-0.0204	0.4651	0.4266	0.6397	-0.6372	-0.1586	0.2612	0.2038	0.4507	-0.2648	0.3472	0.0000	0.6505	1.1143
2l I 0.86v	0.4977	0.4885	0.4768	0.5005	0.5052	0.4911	0.4912	0.4950	0.4939	0.4853	0.5028	0.5061	0.4980	0.4915	0.4888	0.4910	0.4892	0.4901	0.4925	0.4924
2l delta %	0.0000	0.0819	-0.4404	0.6394	0.6532	17.0230	0.3054	0.5657	0.7491	0.7830	-0.5171	0.1778	0.3213	0.3866	0.5933	-0.2648	0.2453	0.0612	0.7716	0.8733
2n I 0.86v	0.4963	0.4870	0.4745	0.4998	0.5028	0.4917	0.4903	0.4934	0.4918	0.4853	0.5020	0.5049	0.4979	0.4921	0.4884	0.4906	0.4896	0.4899	0.4914	0.4919
2n delta %	-0.2821	-0.2259	-0.9273	0.5002	0.1790	17.1243	0.1224	0.2432	0.3253	0.7830	-0.6773	-0.0594	0.3013	0.5080	0.5119	-0.3465	0.3268	0.0204	0.5495	0.7725
2p I 0.86v	0.4964	0.4882	0.4753	0.5004	0.5044	0.4916	0.4905	0.4948	0.4931	0.4857	0.5039	0.5052	0.4972	0.4913	0.4880	0.4912	0.4885	0.4883	0.4915	0.4926
2p delta %	-0.2619	0.0205	-0.7574	0.6195	0.4956	17.1074	0.1631	0.5255	0.5881	0.8647	-0.2977	0.0000	0.1609	0.3460	0.4303	-0.2239	0.1024	-0.3072	0.5697	0.9135
2r I 0.86v	0.4971	0.4845	0.4720	0.5008	0.5038	0.4916	0.4908	0.4936	0.4928	0.4847	0.5024	0.5049	0.4972	0.4913	0.4877	0.4906	0.4900	0.4891	0.4904	0.4922
2r delta %	-0.1207	-0.7430	-1.4619	0.6989	0.3771	17.1074	0.2241	0.2836	0.5276	0.6602	-0.5971	-0.0594	0.1609	0.3460	0.3691	-0.3465	0.4082	-0.1431	0.3467	0.8330
2t I 0.86v	0.4960	0.4852	0.4723	0.5003	0.5049	0.4916	0.4911	0.4931	0.4922	0.4850	0.5033	0.5053	0.4982	0.4920	0.4887	0.4899	0.4897	0.4892	0.4917	0.4918
2t delta %	-0.3427	-0.5977	-1.3974	0.5996	0.5942	17.1074	0.2851	0.1825	0.4063	0.7216	-0.4172	0.0198	0.3613	0.4878	0.5729	-0.4899	0.3472	-0.1226	0.6101	0.7523
3b I 0.86v	0.4957	0.4838	0.4706	0.4986	0.5000	0.4934	0.4908	0.4934	0.4916	0.4831	0.5053	0.4932	0.4967	0.4866	0.4862	0.4934	0.4906	0.4890	0.4892	0.4903
3b delta %	-0.4035	-0.8888	-1.7637	0.2607	-0.3800	17.4098	0.2241	0.2432	0.2848	0.3312	-0.0198	-2.4331	0.0604	-0.6165	0.0617	0.2229	0.5300	-0.1636	0.1022	0.4487
3d I 0.86v	0.4957	0.4849	0.4694	0.4990	0.4996	0.4925	0.4904	0.4935	0.4898	0.4834	0.5046	0.4931	0.4965	0.4853	0.4853	0.4932	0.4895	0.4870	0.4879	0.4901
3d delta %	-0.4035	-0.6599	-2.0239	0.3407	-0.4604	17.2589	0.1427	0.2634	-0.0817	0.3930	-0.1585	-2.4539	0.0201	-0.8860	-0.1236	0.1825	0.3064	-0.5749	-0.1640	0.4081
3f I 0.86v	0.4952	0.4853	0.4709	0.4976	0.5002	0.4933	0.4901	0.4928	0.4896	0.4834	0.5045	0.4930	0.4961	0.4865	0.4858	0.4930	0.4899	0.4863	0.4883	0.4914
3f delta %	-0.5048	-0.5770	-1.6989	0.0603	-0.3399	17.3931	0.0816	0.1218	-0.1225	0.3930	-0.1784	-2.4746	-0.0605	-0.6372	-0.0206	0.1420	0.3878	-0.7197	-0.0819	0.6716
3h I 0.86v	0.4949	0.4840	0.4603	0.4927	0.4952	0.4795	0.4814	0.4879	0.4869	0.4706	0.5003	0.4901	0.4877	0.4801	0.4798	0.4875	0.4852	0.4770	0.4623	0.4870
3h delta %	-0.5658	-0.8471	-4.0408	-0.9336	-1.3530	15.0156	-1.7241	-0.8813	-0.6778	-2.3162	-1.0194	-3.0810	-1.7839	-1.9788	-1.2714	-0.9846	-0.5771	-2.6834	-5.7106	-0.2259
SEQ	BT1	BT2	BT3	BT4	BT5	BT6	BT7	BT8	BT9	BT10	BT11	BT12	BT13	BT14	BT15	BT16	BT17	BT18	BT19	BT20
4b I 0.86v	0.4944	0.4812	0.4595	0.4853	0.4900	0.4812	0.4745	0.4864	0.4883	0.4681	0.4953	0.4850	0.4848	0.4671	0.4643	0.4809	0.4823	0.4796	0.4618	0.4810
4b delta %	-0.6675	-1.4339	-4.2220	-2.4727	-2.4286	15.3159	-3.2034	-1.1924	-0.3891	-2.8626	-2.0392	-4.1649	-2.3927	-4.8170	-4.6522	-2.3706	-1.1818	-2.1268	-5.8250	-1.4761
4d I 0.86v	0.4820	0.4797	0.4566	0.4660	0.4884	0.4861	0.4612	0.4713	0.4824	0.4597	0.4574	0.4591	0.4673	0.4397	0.4361	0.4776	0.4770	0.4704	0.4479	0.4730
4d delta %	-3.2573	-1.7511	-4.8839	-6.7167	-2.7641	16.1695	-6.1795	-4.4345	-1.6169	-4.7422	-10.4941	-10.0414	-6.2273	-11.3486	-11.4194	-3.0779	-2.3061	-4.1241	-9.1092	-3.1924
4f I 0.86v	0.4915	0.4870	0.4606	0.4687	0.4942	0.4706	0.4686	0.4792	0.4790	0.4678	0.4648	0.4731	0.4747	0.4479	0.4420	0.4834	0.4854	0.4776	0.4562	0.4835
4f delta %	-1.2614	-0.2259	-3.9731	-6.1020	-1.5581	13.4084	-4.5028	-2.7129	-2.3382	-2.9286	-8.7349	-6.7850	-4.5713	-9.3101	-9.9321	-1.8411	-0.5356	-2.5544	-7.1241	-0.9514
4f I 0.86v	0.4782	0.4747	0.4506	0.4541	0.4786	0.4615	0.4532	0.4627	0.4696	0.4555	0.4511	0.4609	0.4582	0.4365	0.4243	0.4717	0.4714	0.4596	0.4401	0.4701
4f delta %	-4.0778	-2.8228	-6.2805	-9.5133	-4.8684	11.7010	-8.0538	-6.3756	-4.3867	-5.7080	-12.0372	-9.6116	-8.3370	-12.1649	-14.5180	-4.3672	-3.5214	-6.5709	-11.0429	-3.8290

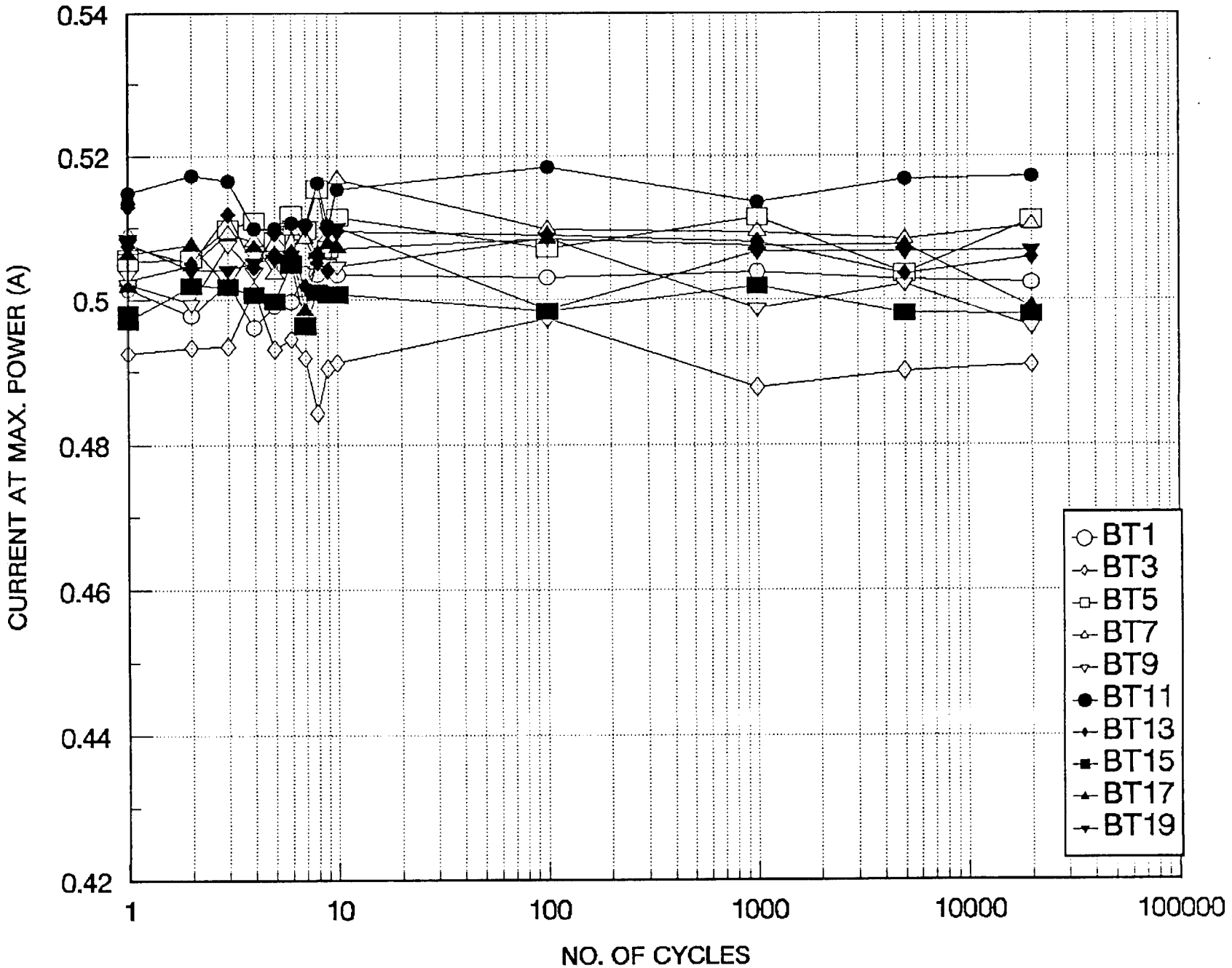
SEQ	BT1	BT2	BT3	BT4	BT5	BT6	BT7	BT8	BT9	BT10	BT11	BT12	BT13	BT14	BT15	BT16	BT17	BT18	BT19	BT20
2b Voc	1.0272	1.0092	1.0043	1.0093	1.0097	0.9899	0.9988	1.0097	1.0034	1.0135	1.0170	1.0031	1.0168	1.0118	1.0094	1.0066	1.0168	1.0022	1.0014	0.9998
2b Isc	0.5465	0.5431	0.5455	0.5482	0.5525	0.5404	0.5532	0.5443	0.5454	0.5371	0.5602	0.5502	0.5523	0.5559	0.5440	0.5447	0.5499	0.5505	0.5554	0.5551
4d Voc	1.0086	1.0058	0.9970	1.0012	1.0063	0.9913	0.9887	1.0038	1.0008	0.9939	1.0006	0.9871	0.9940	0.9811	0.9934	1.0008	0.9983	0.9955	0.9872	0.9927
4d Isc	0.5463	0.5440	0.5462	0.5496	0.5555	0.5533	0.5554	0.5451	0.5464	0.5382	0.5605	0.5515	0.5519	0.5567	0.5444	0.5454	0.5509	0.5504	0.5553	0.5564

7 492 nm @ 870 mV
8 500 nm @ 870 mV
9 508 nm @ 870 mV

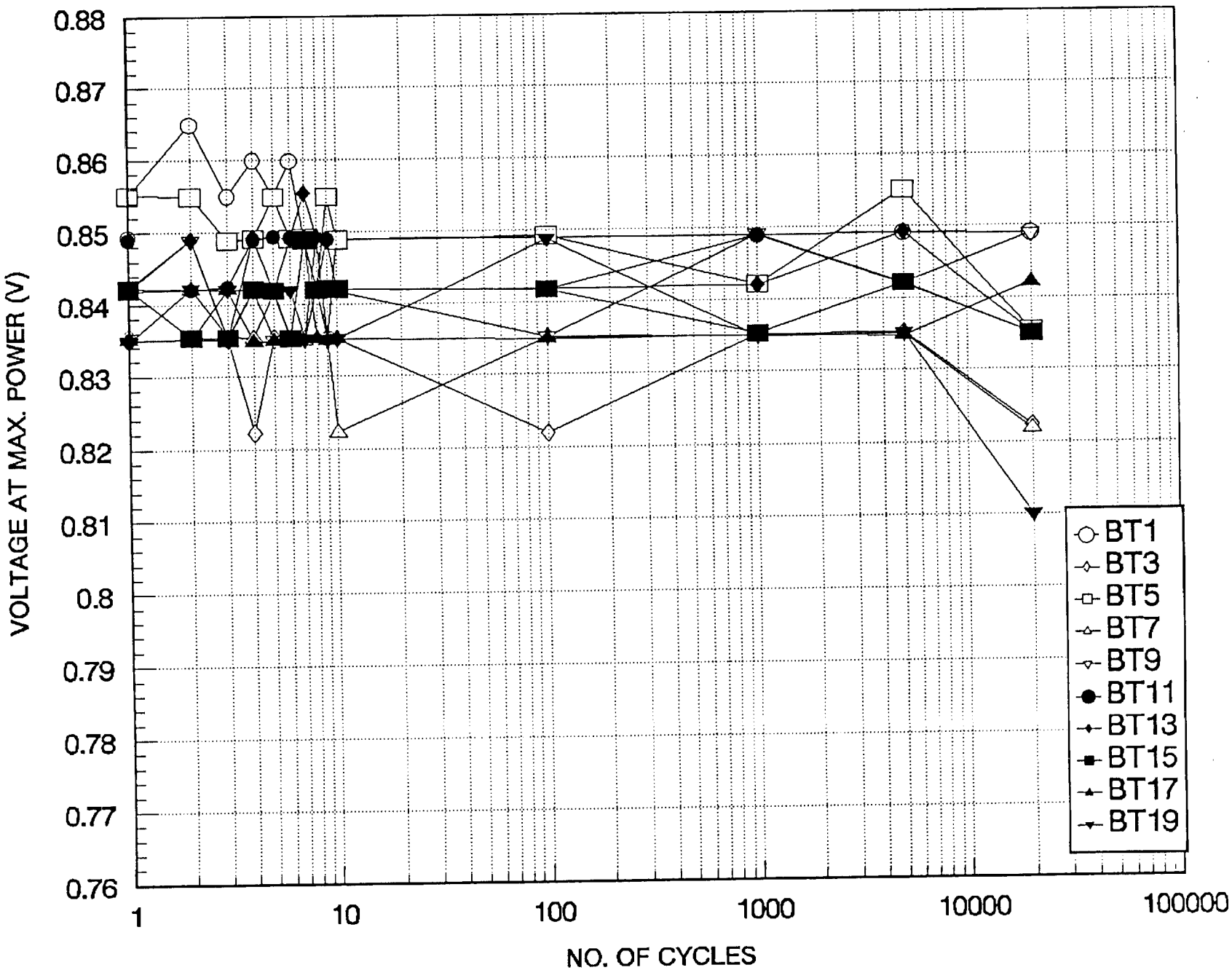
	I_{sc}	V_{oc}	V_{mp}	I_{mp}	P_{mp}	I_v	ΔV	FF	η
1	.5481	1.0168	.8493	.5046	.4286	.4977	11	.769	18.0
2	.5455	1.0109	.8421	.5022	.4212	.4881	18	.764	17.7
3	.5464	1.0067	.8355	.4965	.4148	.4789	25	.754	17.4
4	.5485	1.0116	.8422	.5087	.4284	.4973	18	.771	18.0
5	.5540	1.0116	.8550	.5058	.4325	.5019	5	.772	18.2
6	.5492	.9912	.8102	.4455	.3609	.4075	50	.663	15.2
7	.5557	1.0012	.8351	.5090	.4251	.4897	25	.764	17.9
8	.5458	1.0123	.8489	.4993	.4239	.4922	11	.767	17.8
9	.5470	1.0058	.8603	.4902	.4239	.4902	18	.771	17.8
10	.5390	1.0044	.8348	.4991	.4166	.4815	25	.770	17.5
11	.5623	1.0070	.8599	.5054	.4359	.5054	11	.770	18.3
12	5515	1.0053	.8493	.5120	.4348	.5052	11	.784	18.3
13	.5529	1.0067	.8352	.5129	.4284	.4964	25	.770	18.0
14	.5568	1.0005	.8352	.5092	.4253	.4896	25	.763	17.9
15	.5452	1.0106	.8421	.4980	.4194	.4859	18	.761	17.6
16	.5470	1.0070	.8422	.5050	.4253	.4923	18	.773	17.9
17	.5526	1.0036	.8421	.5018	.4226	.4880	18	.762	17.8
18	.5527	1.0020	.8349	.5076	.4238	.4898	25	.765	17.8
19	.5558	1.0009	.8349	.5085	.4245	.4887	25	.757	17.8
20	.5566	.9993	.8422	.5041	.4246	.4881	18	.764	17.8
$\bar{x}$	.5508	1.0065	.8432	.5042	.4252	.4919	18.4	.767	17.87
σ	.0054 (.98%)	.0046 (.45%)	.0082 (.97%)	.0056 (1.1%)	.0053 (1.2%)	.0070 (1.42%)	6.1	.0064	.23
σ_{n-1}	.0055	.0048	.0085	.0057	.0055	.0072		.0066	.24
with #6									
$\bar{x}$	.5506	1.0058	.8416	.5013	.4220	.4877	20.0	.762	17.74
σ	.0053	.0056	.0108	.0139	.0149	.0196	9.1	.0235	.62
σ_{n-1}	.0054	.0058	.0111	.0143	.0153	.0201	9.3	.0241	.64

16.8 mV low based on $\bar{V}_{max}$ – 860 mV
18.4 mV low based on $\overline{\Delta V}$

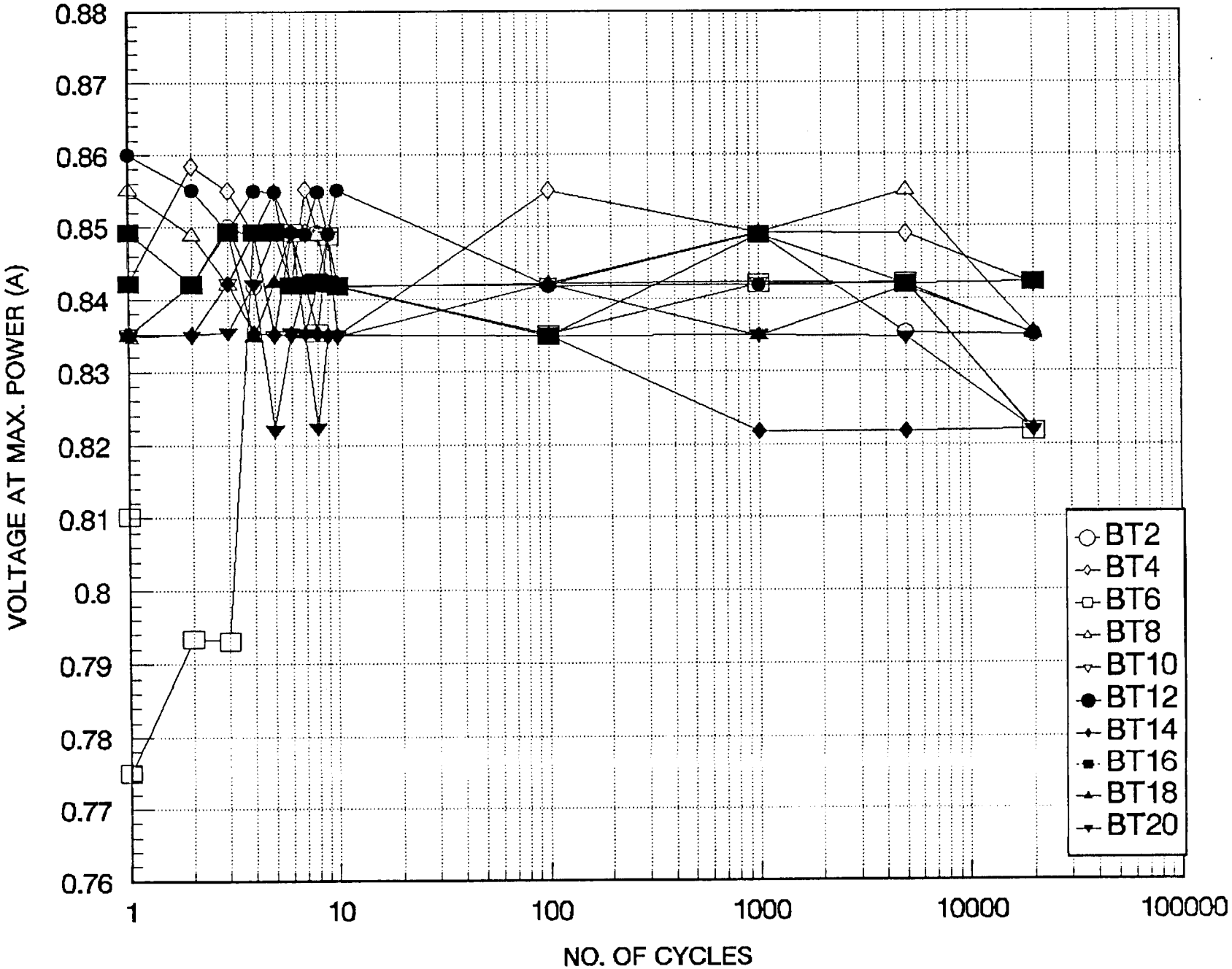
TRMM REVERSE BIAS TEST



TRMM REVERSE BIAS TEST



TRMM REVERSE BIAS TEST



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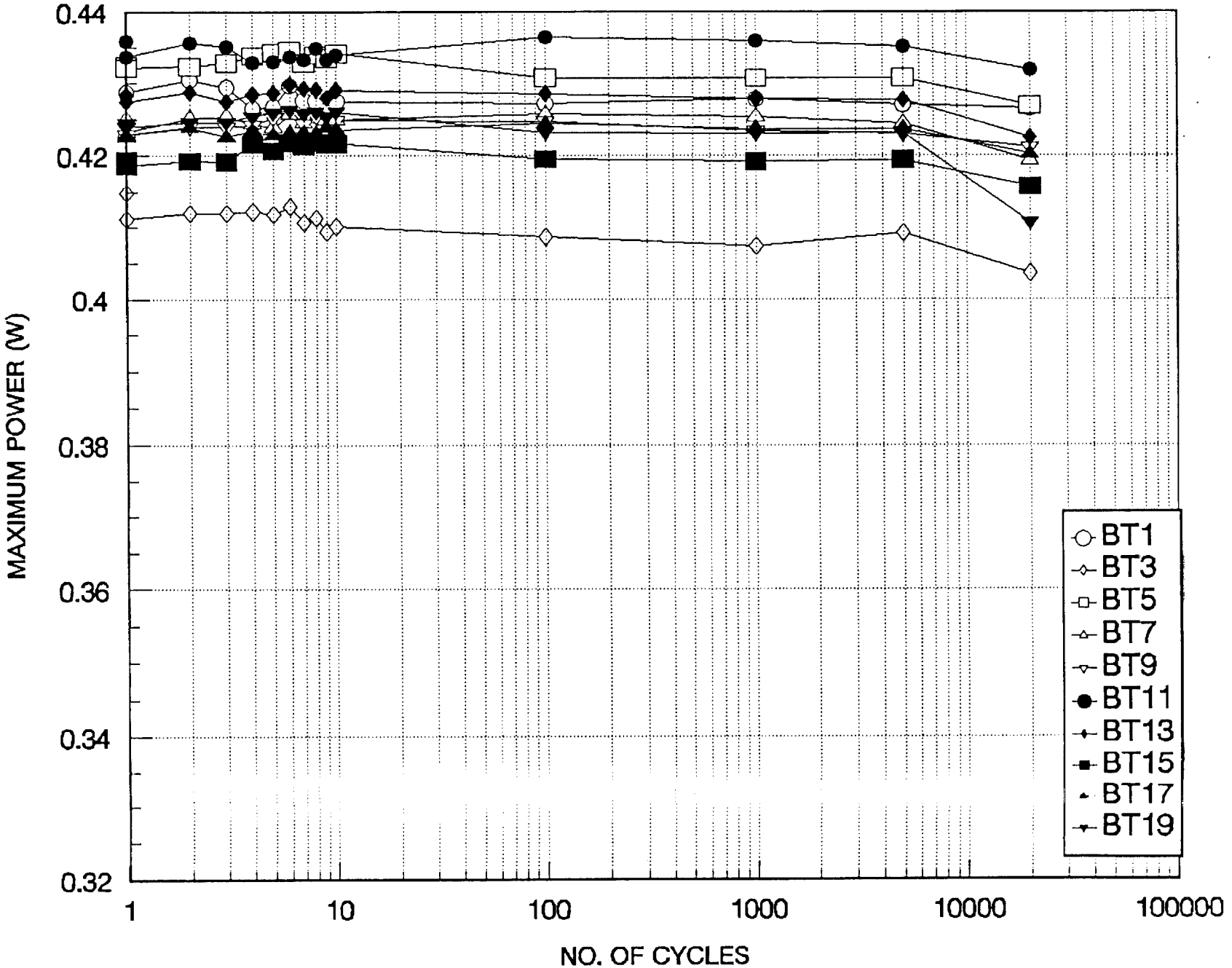

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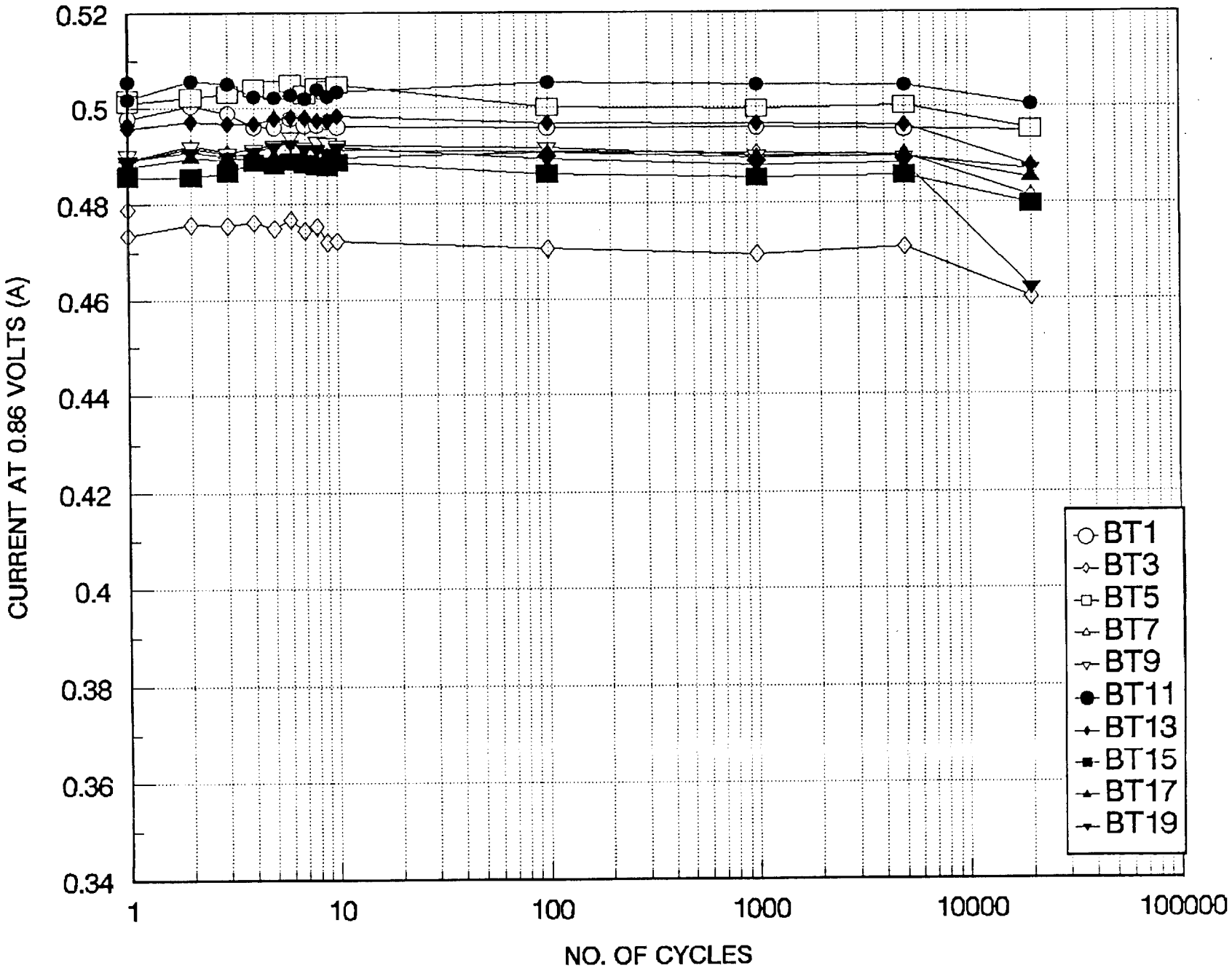

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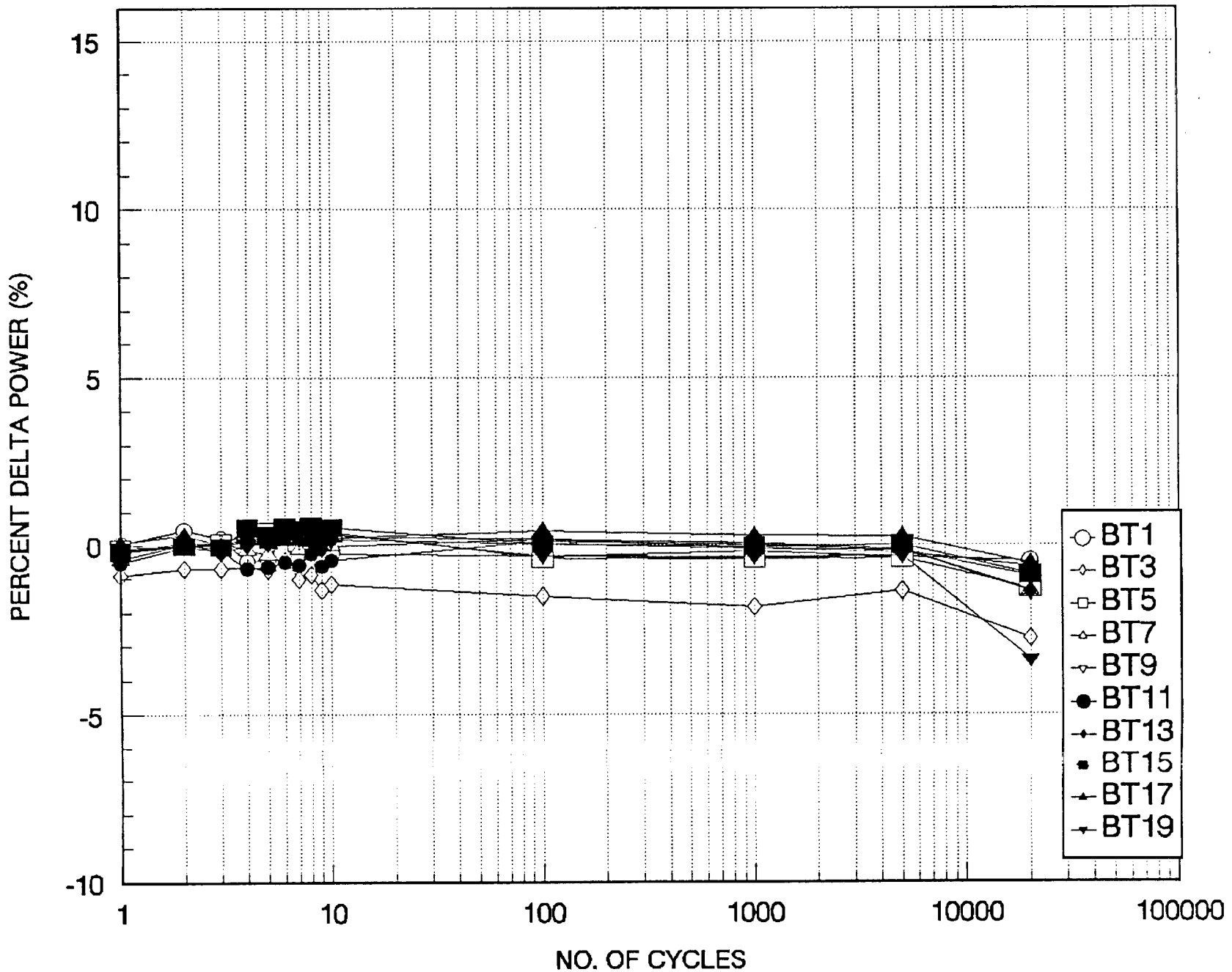

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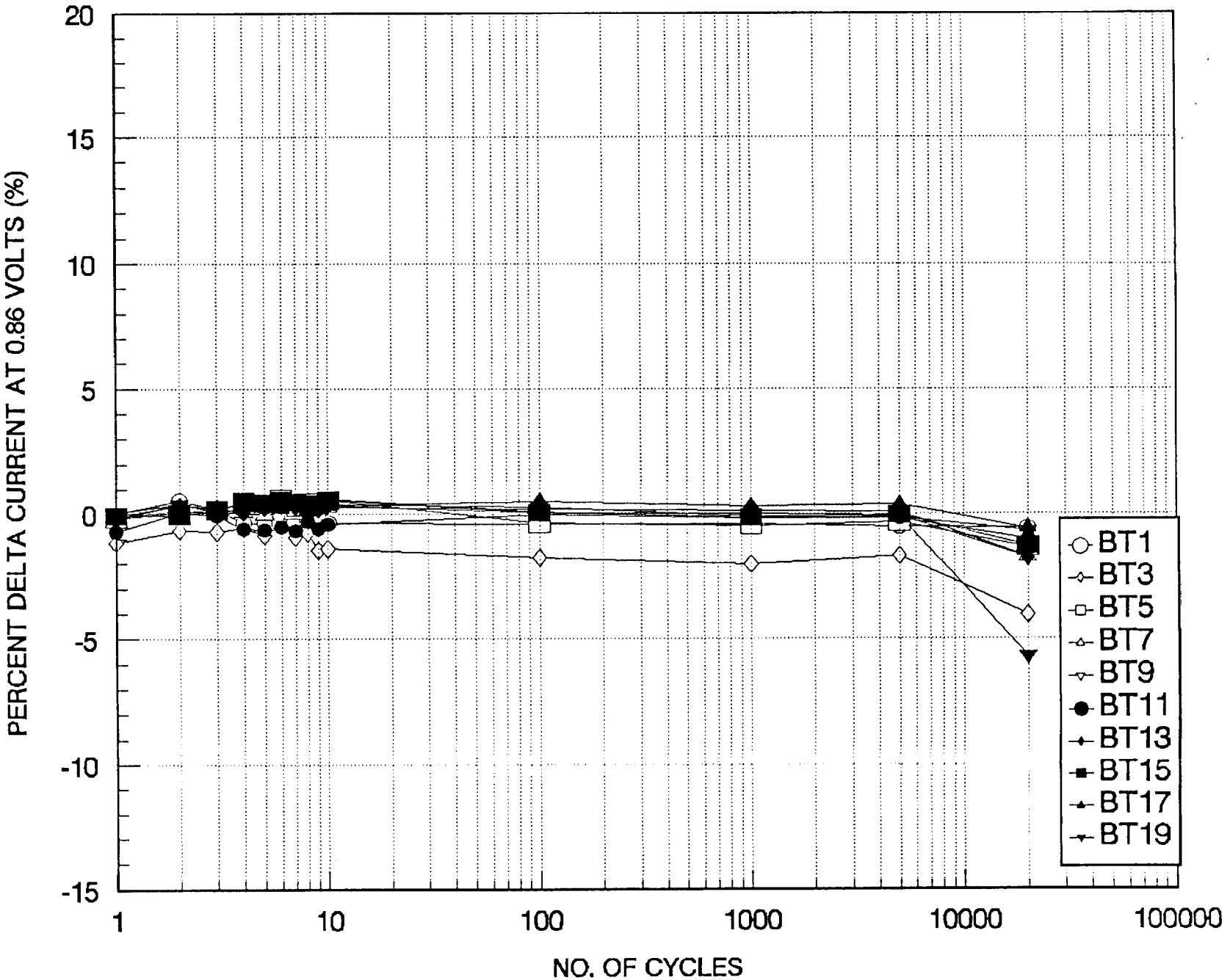

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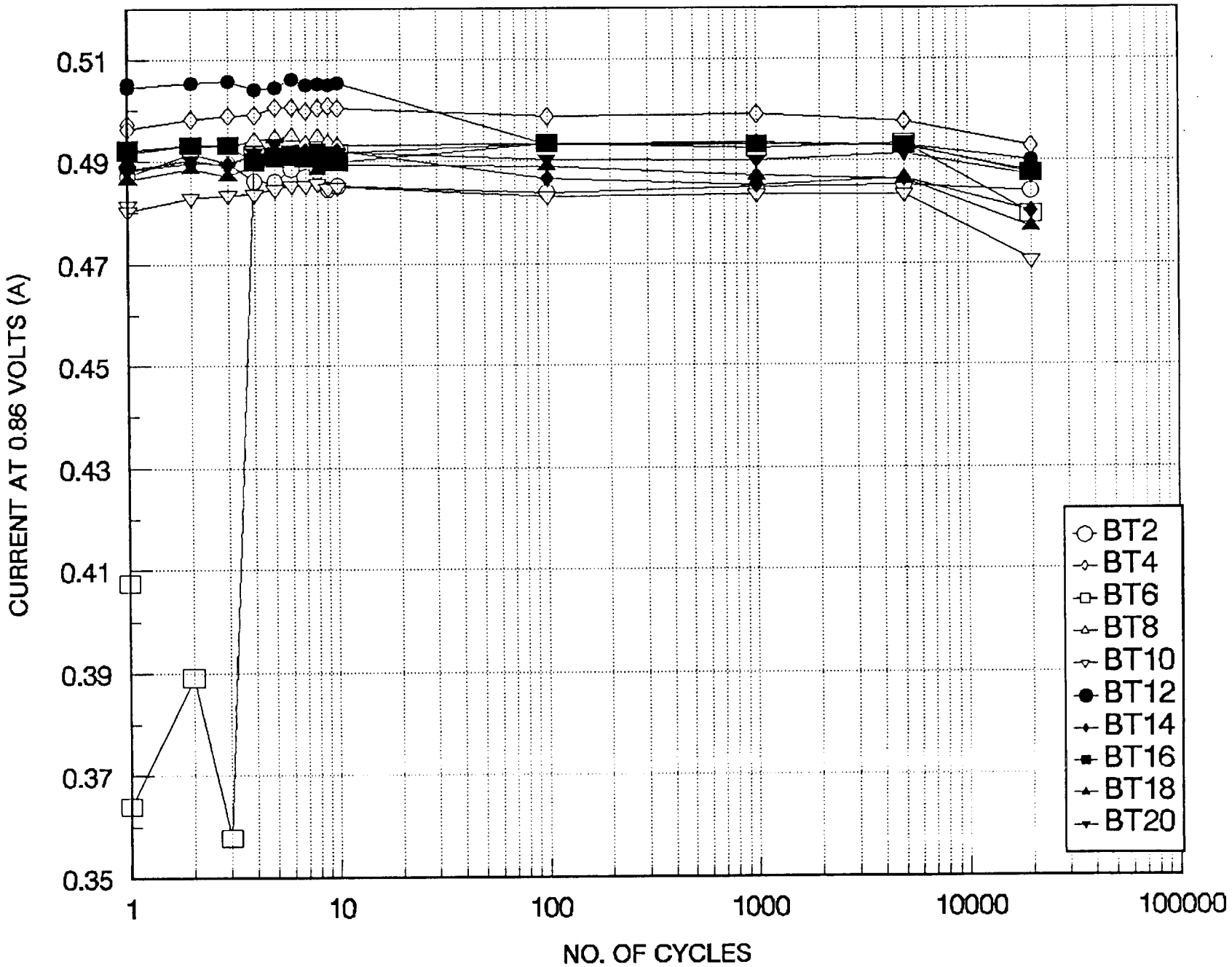

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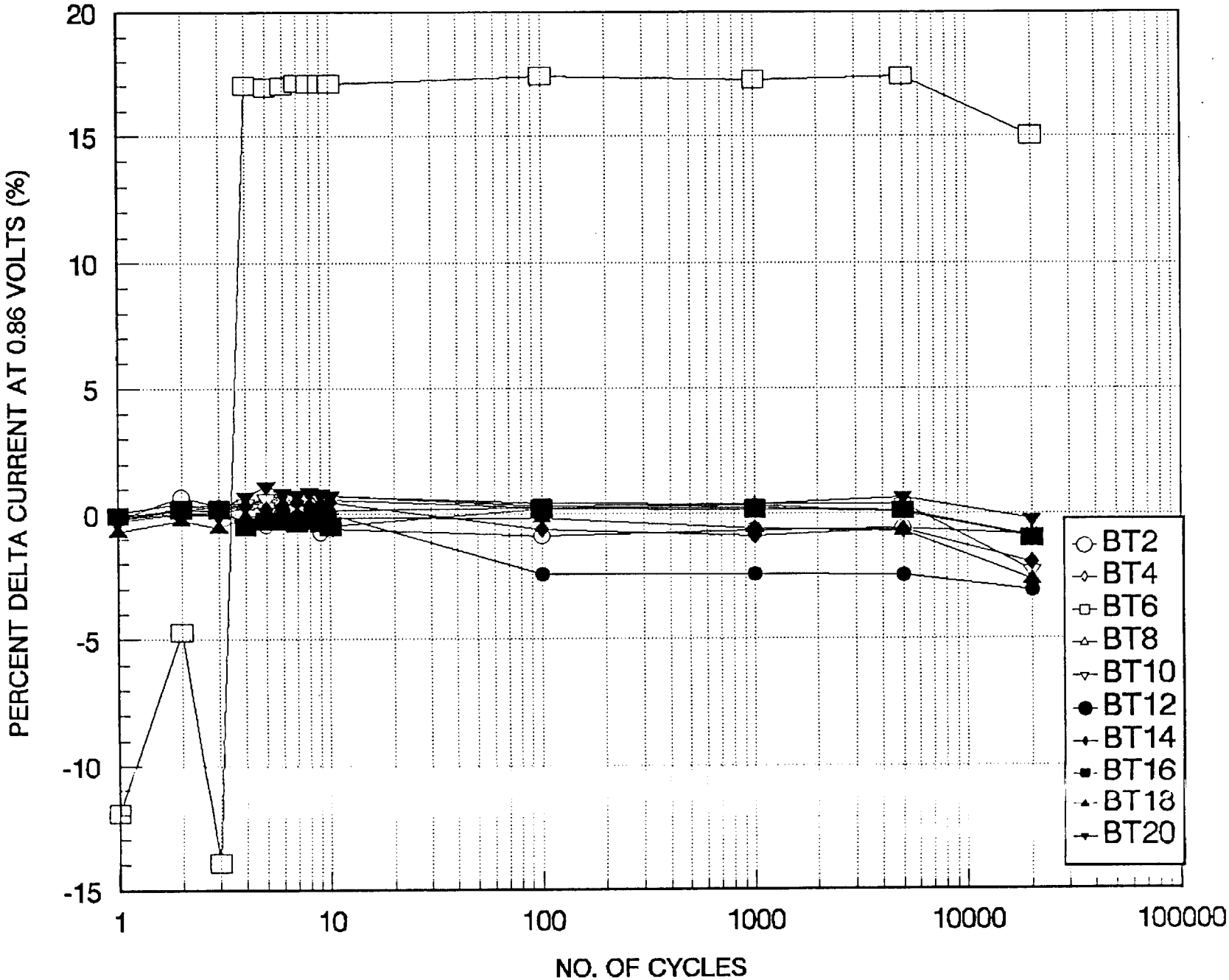

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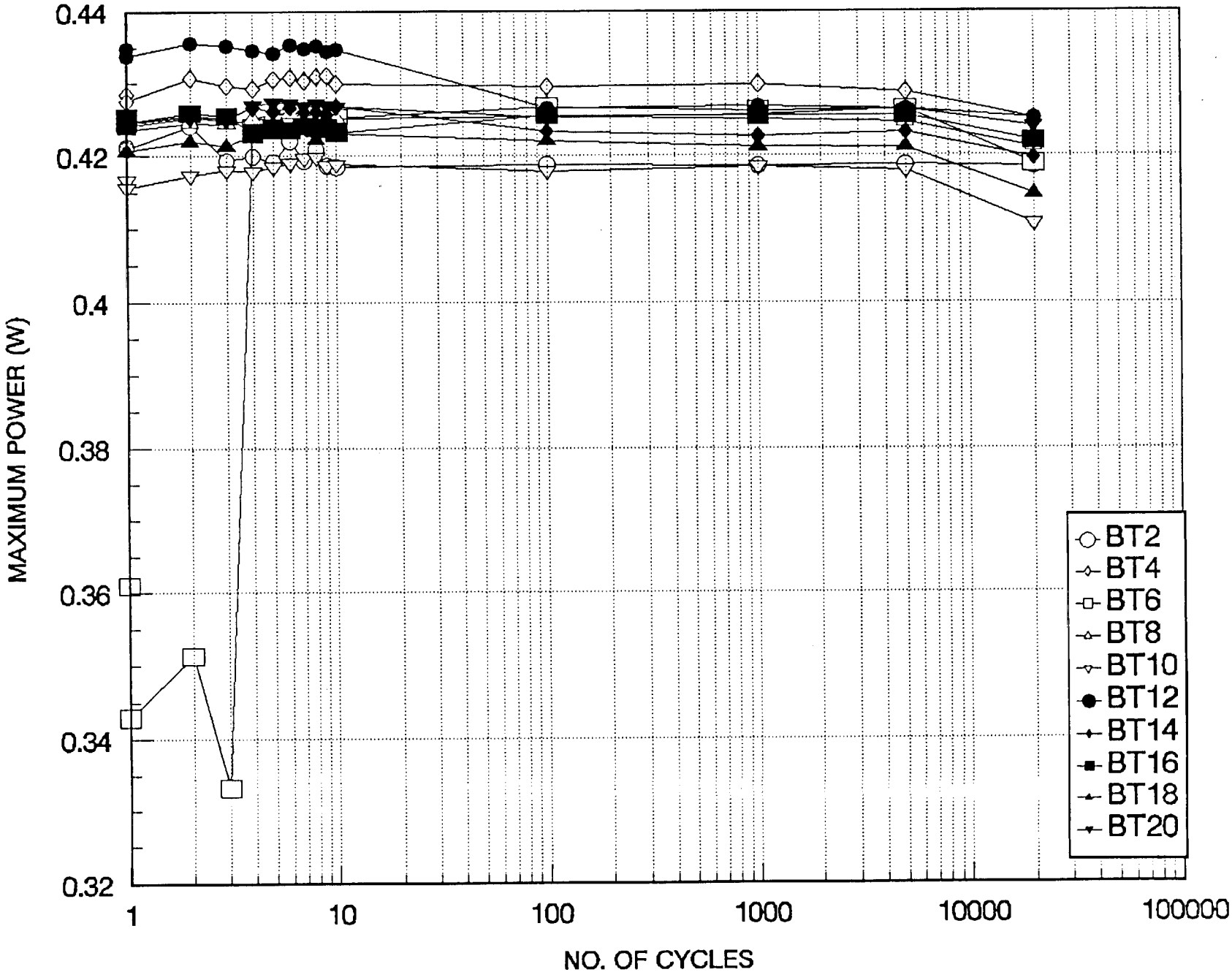

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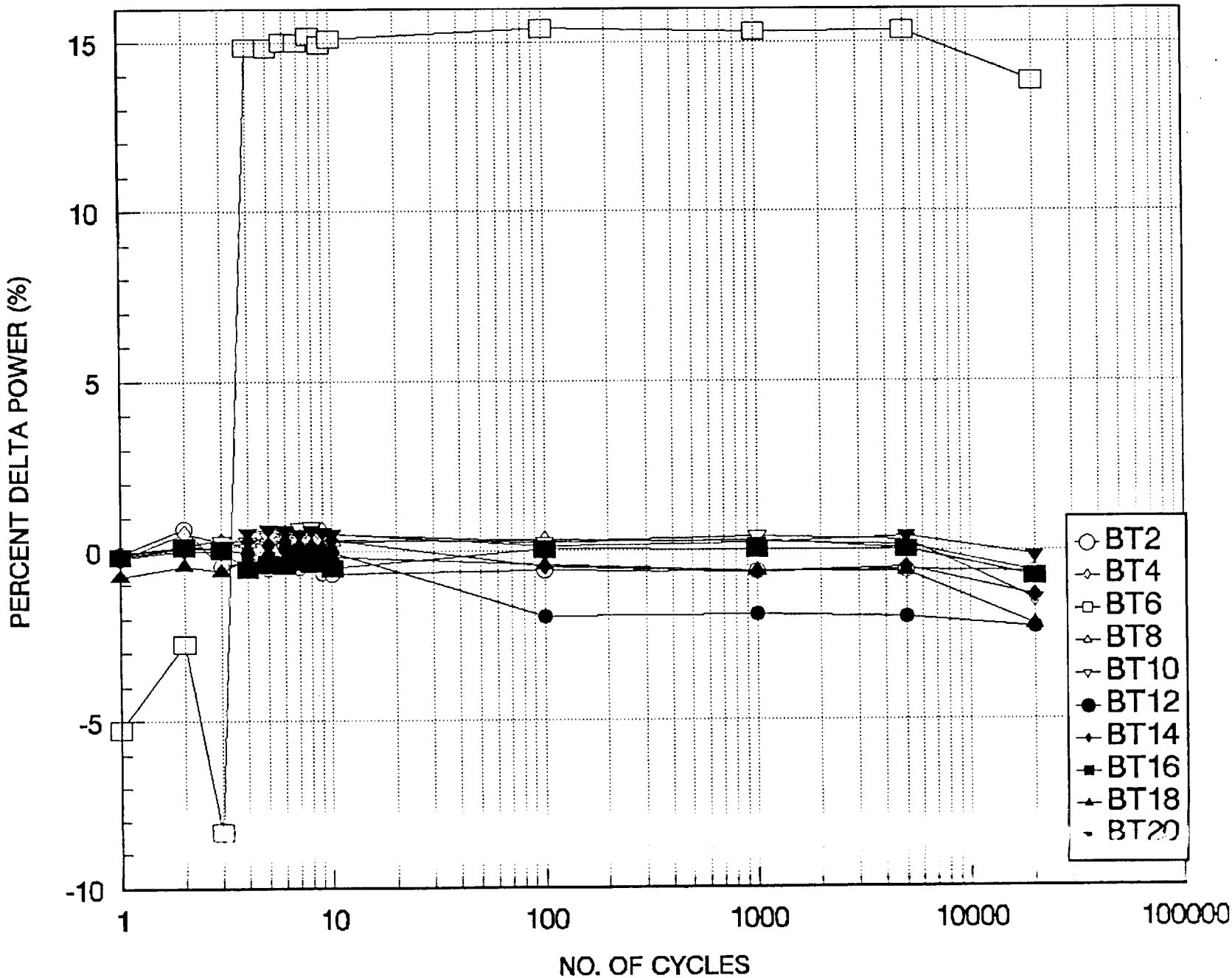

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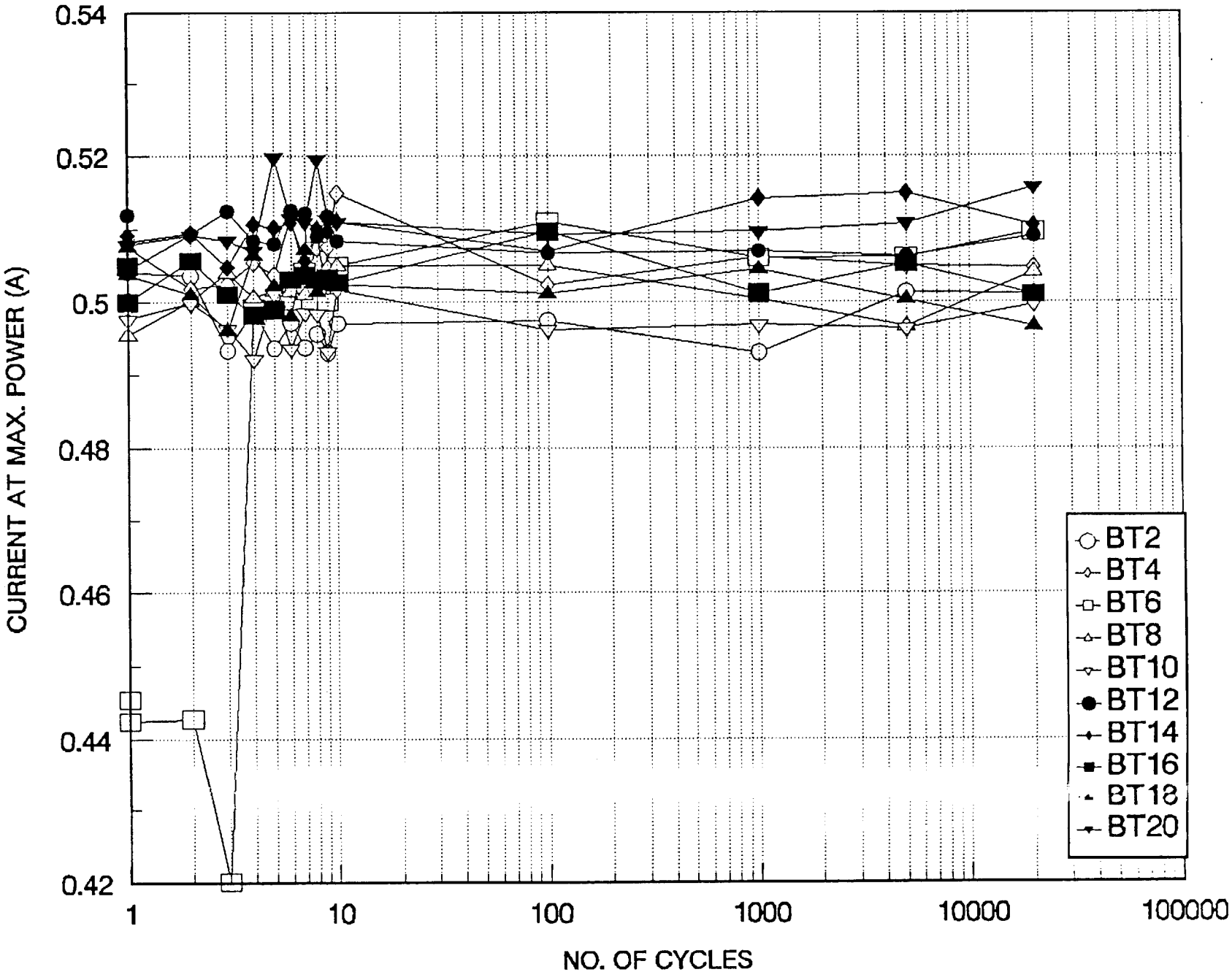


TRW

TRMM
PANEL 828340-1 AND 828360-1

- NMR Summary
  - Paretto Charts
- Summary of cracked cells by process
- Use as is and repair Disposition summary
  - Paretto Charts
- Interconnect Defects
- Cell Stack Defects

May 8, 1996
Fernando Corella

82834O-1 OUTBOARD S/A PANEL
TRMM Panel Q.A. NMR Summary

MODULE ASSEMBLY Defect Type	Number of Line Items	Corrective Action
Cracked cells	17	Inherent limitation, None Required
Contamination in solder joint, fibers	4	Inherent limitations, None Required
Cracked coverglass	1	Inherent limitations, None Required
Wrong termination strip installed	1	Employee counseled
Insufficient solder in solder joint	1	Inherent limitations of the process: None Required
Contamination in solder joint, adhesive	1	Inherent limitation, None Required
PANEL ASSEMBLY		
Cracked cells	9	Inherent limitations of the lay-down process None Required
Bonded module strings misoriented	2	Employees counseled
Cracked coverglass	1	Inherent limitations, None Required

828340-1 OUTBROAD S/A PANEL
TRMM Panel Q.A. NMR Summary

PANEL ASSEMBLY CONTINUED

Thermistor continuity failure	1	None Required, data will be reported to GSFC who directed the procurement of this device
Cells used in rework of panel are of a lower MA of the cells being replaced	1	Inherent limitations, None Required cells of a higher MA value were not available

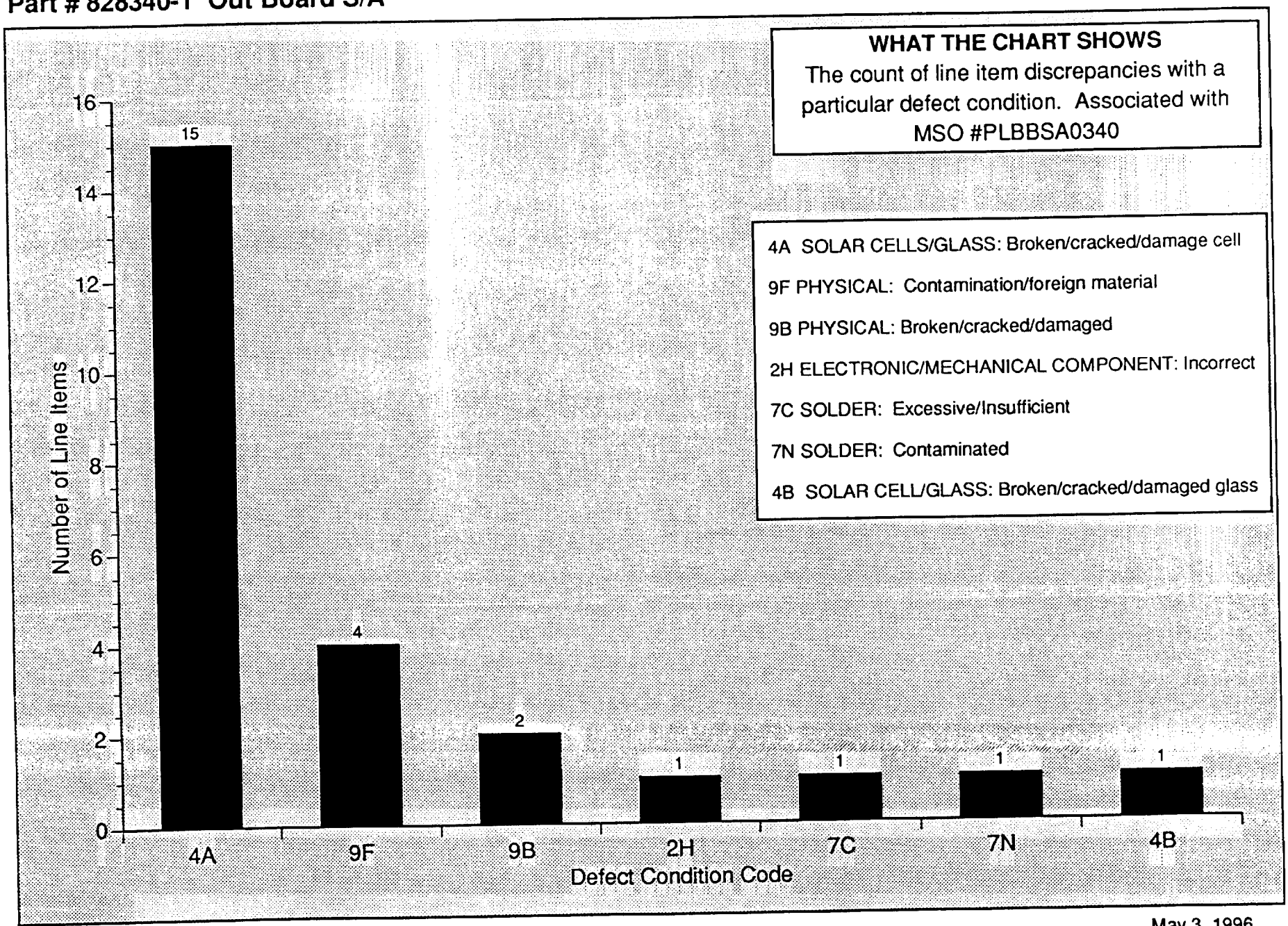
POST ACOUSTIC Defect Type	Number of Line Items	Corrective Action
No defects		

POST THERMAL VACUUM

Cracked cells	4	Inherent limitations of the process: manufacturing and environmental testing
Cracked coverglass	1	Inherent limitations of the process: manufacturing and environmental testing
Damaged interconnect, damaged during a rework operation	1	Employee counseled
.Chipped coverglass	1	Inherent limitations, None Required

Pow. Sources- Project TRMM (Module (sembly)

Part # 828340-1 Out Board S/A



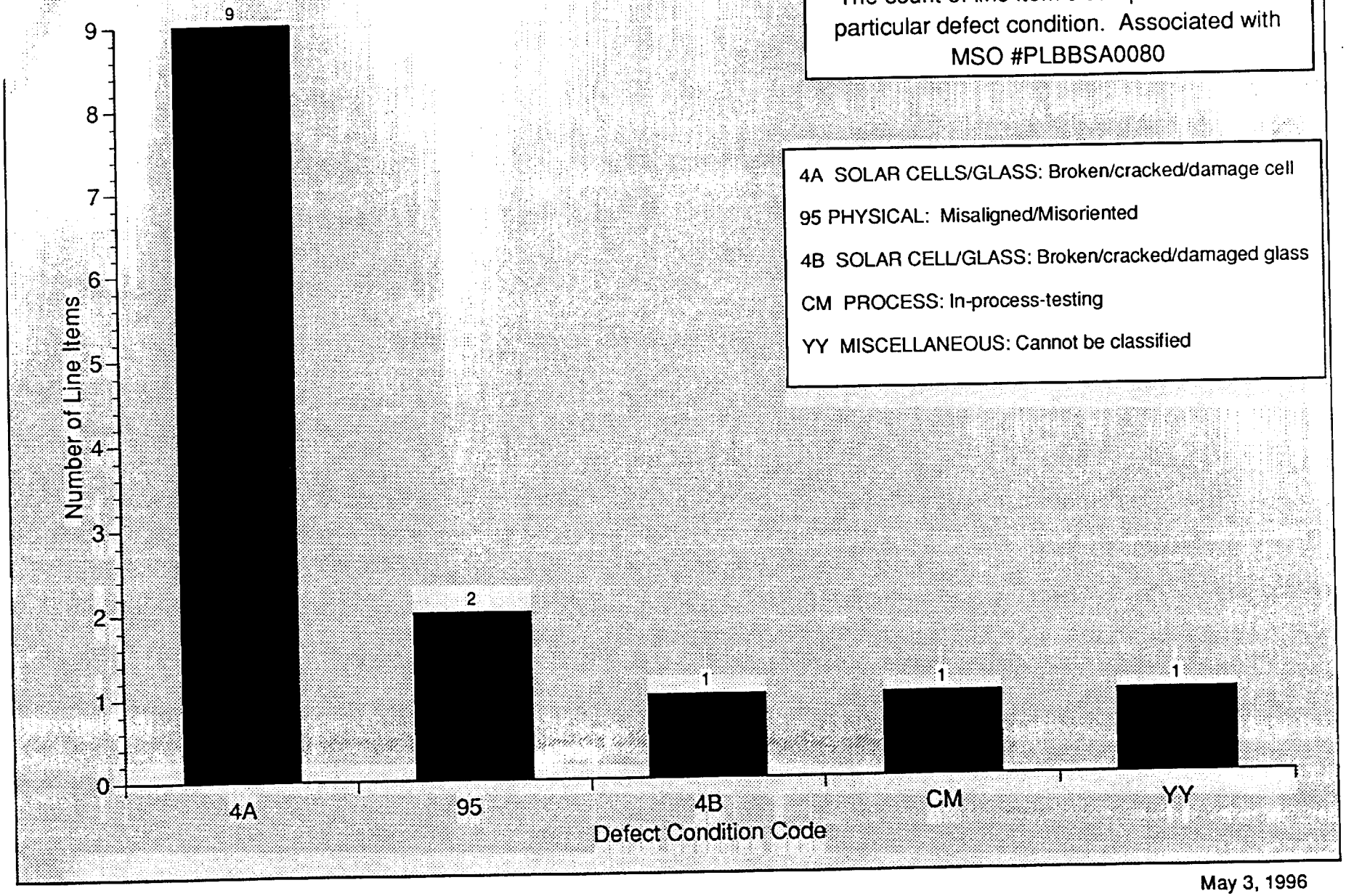
May 3, 1996

...r Sources- Project TRMM (Panel A...sembly)

...# 828340-1 Out Board S/A

WHAT THE CHART SHOWS

The count of line item discrepancies with a particular defect condition. Associated with MSO #PLBBSA0080



4A SOLAR CELLS/GLASS: Broken/cracked/damage cell

95 PHYSICAL: Misaligned/Misoriented

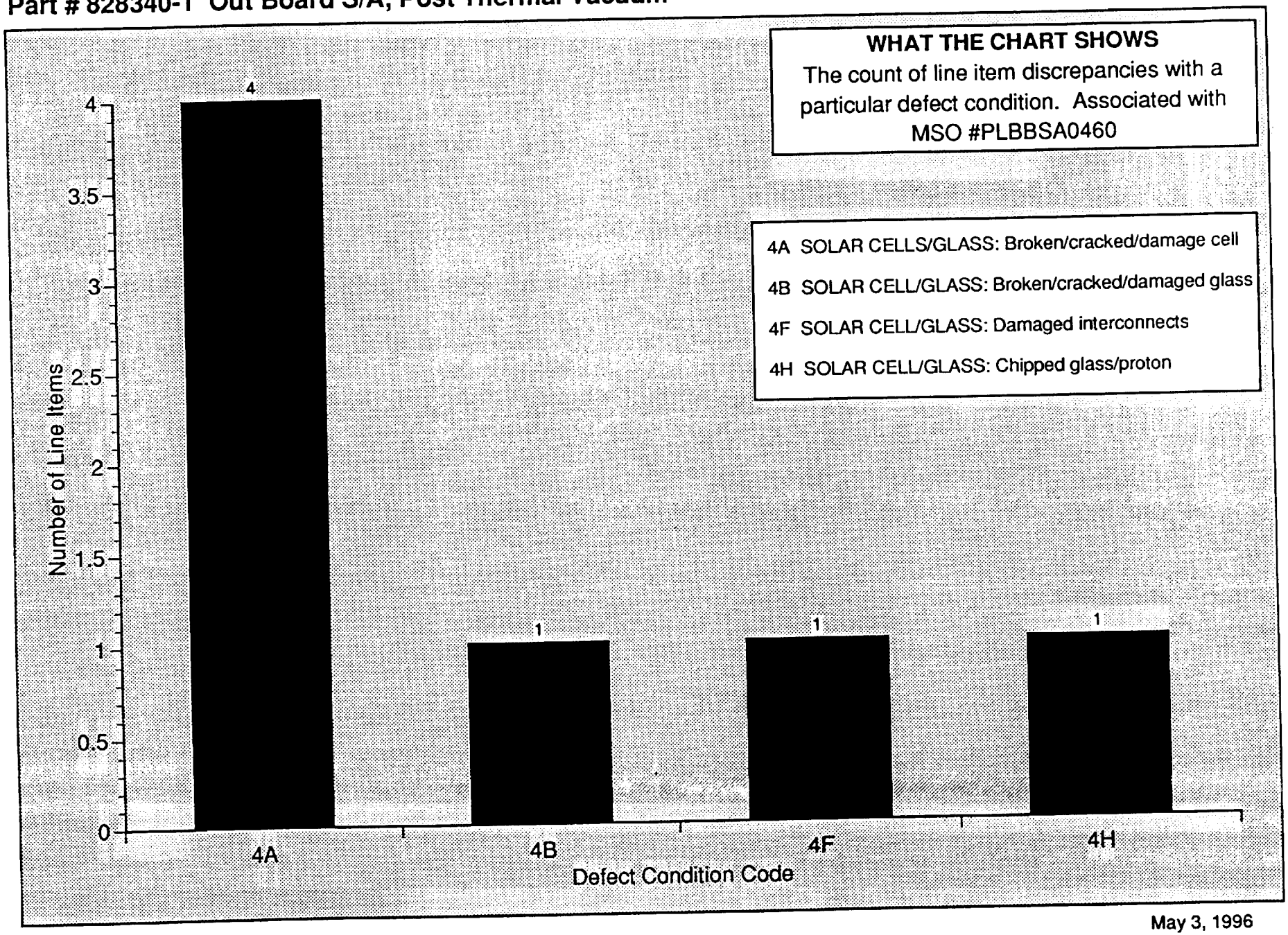
4B SOLAR CELL/GLASS: Broken/cracked/damaged glass

CM PROCESS: In-process-testing

YY MISCELLANEOUS: Cannot be classified

May 3, 1996

Power Sources- Project TRMM
Part # 828340-1 Out Board S/A, Post Thermal Vacuum



May 3, 1996

828360-1 +Y INBROAD S/A PANEL
TRMM Panel Q.A. NMR Summary

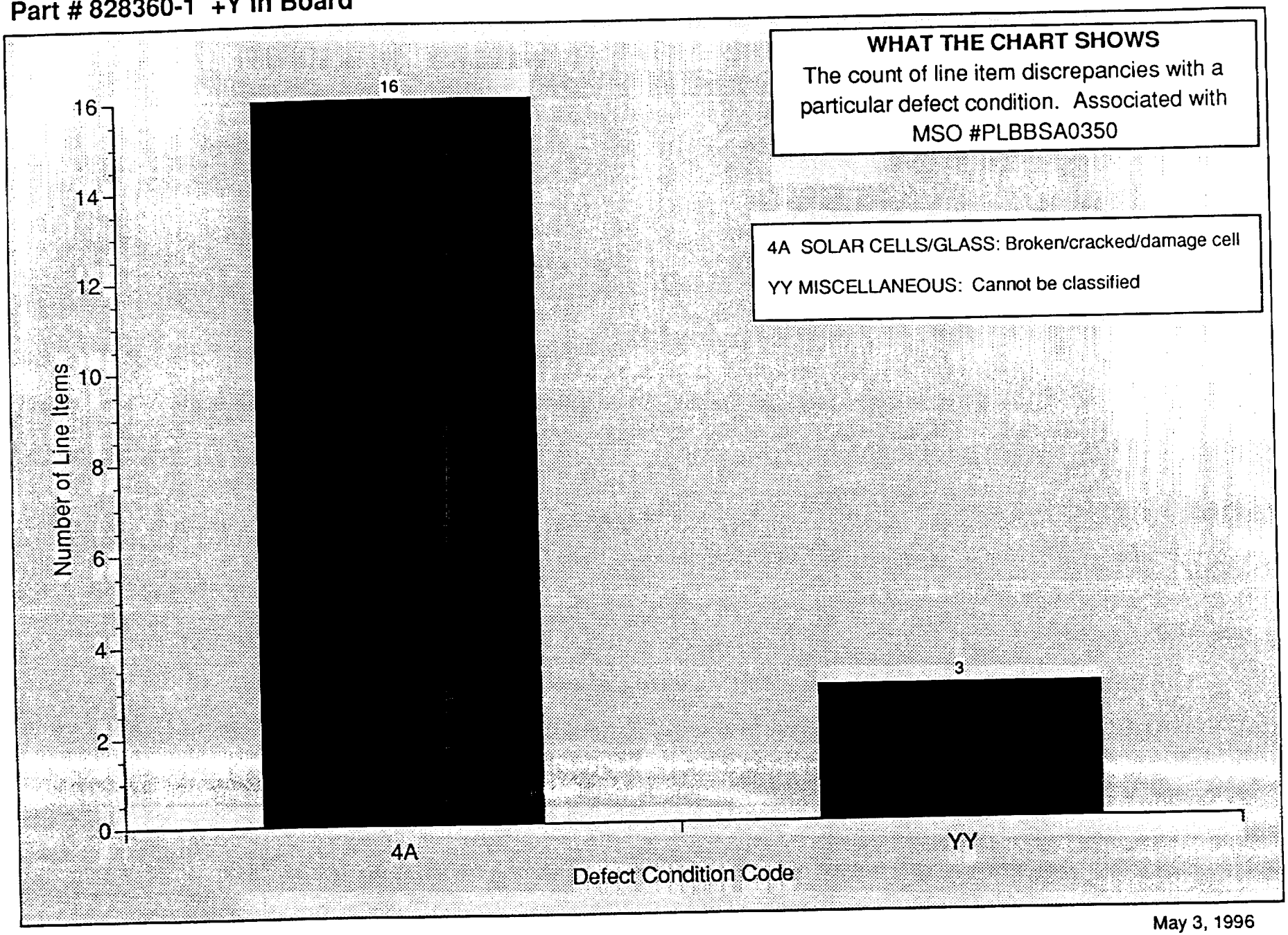
MODULE ASSEMBLY Defect Type	Number of Line Items	Corrective Action
Cracked cells	16	Inherent limitation, None Required
Blemish on cell	2	Under Investigation
Void in P-collector strip	1	Supplier Action
PANEL ASSEMBLY		
Cracked cells	2	Inherent Limitation, None Required
Chipped Coverglass	1	Employee Counseled
Incorrect Wiring	1	Employee Counseled
Thermistor continuity failure	1	None required GSFC directed procurement of device
POST ACOUSTIC		
No Defects		

828360-1 +Y INBROAD S/A PANEL
TRMM Panel Q.A. NMR Summary

Post Thermal Vacuum Defect Type	Number of Line Items	Corrective Action
Panel exceeds limits is 18.56 lbs s/b <= 18.07 lbs	1	Recommend customer specification change
Thermistor continuity failure exceeds limits	1	Recommend customer specification change
Cracked cells	2	Inherent limitations of the process: manufacturing and environmental testing
Bubbles formed on panel from Thermal Test	1	Under Investigation
Damaged glass	1	Employee counseled

Power Sources- Project TRMM (Module Assembly)

Part # 828360-1 +Y In Board



May 3, 1996

Sources- Project TRMM (Panel Assembly)

art # 823630-1 +Y In Board

WHAT THE CHART SHOWS

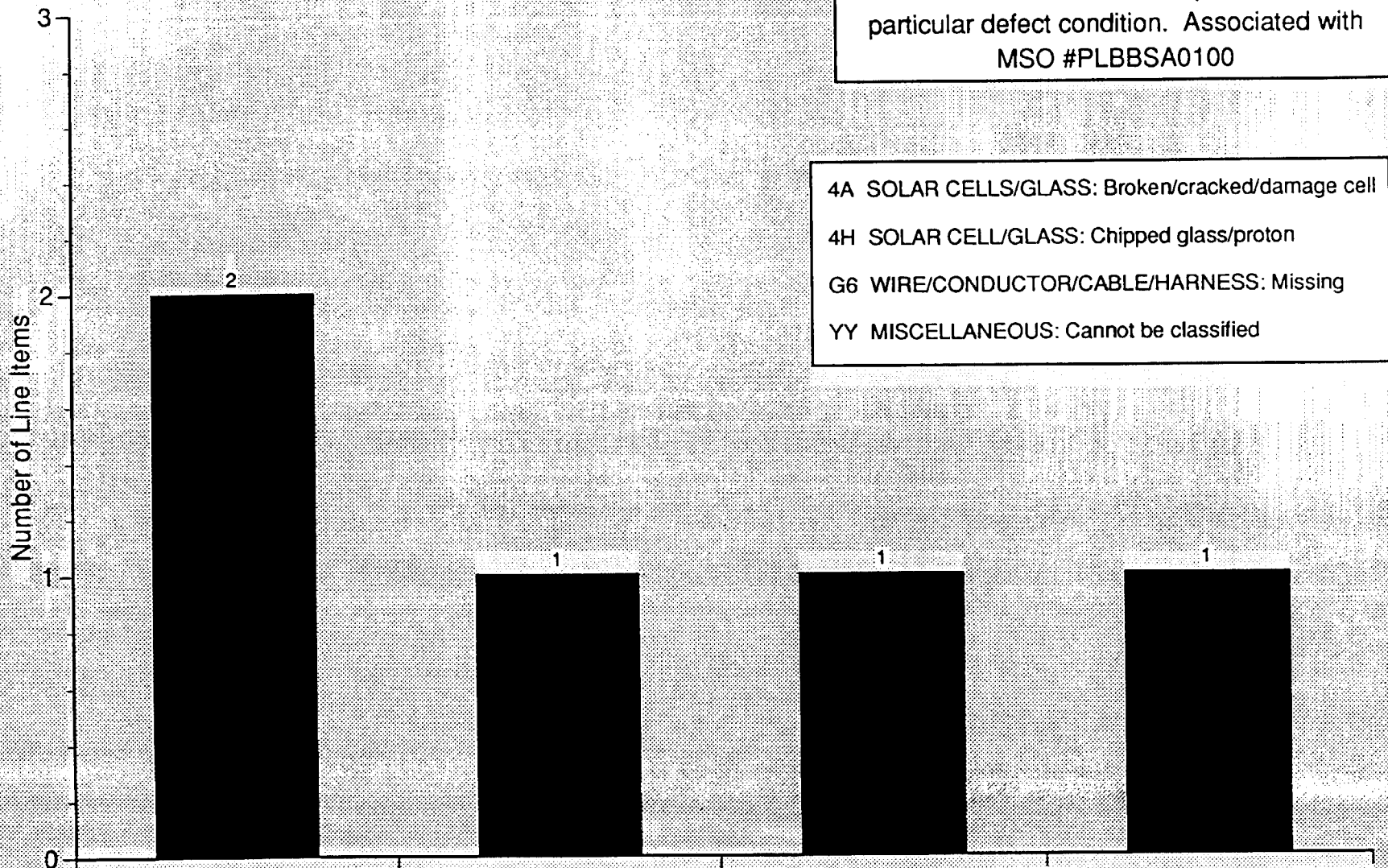
The count of line item discrepancies with a particular defect condition. Associated with MSO #PLBBSA0100

4A SOLAR CELLS/GLASS: Broken/cracked/damage cell

4H SOLAR CELL/GLASS: Chipped glass/proton

G6 WIRE/CONDUCTOR/CABLE/HARNESS: Missing

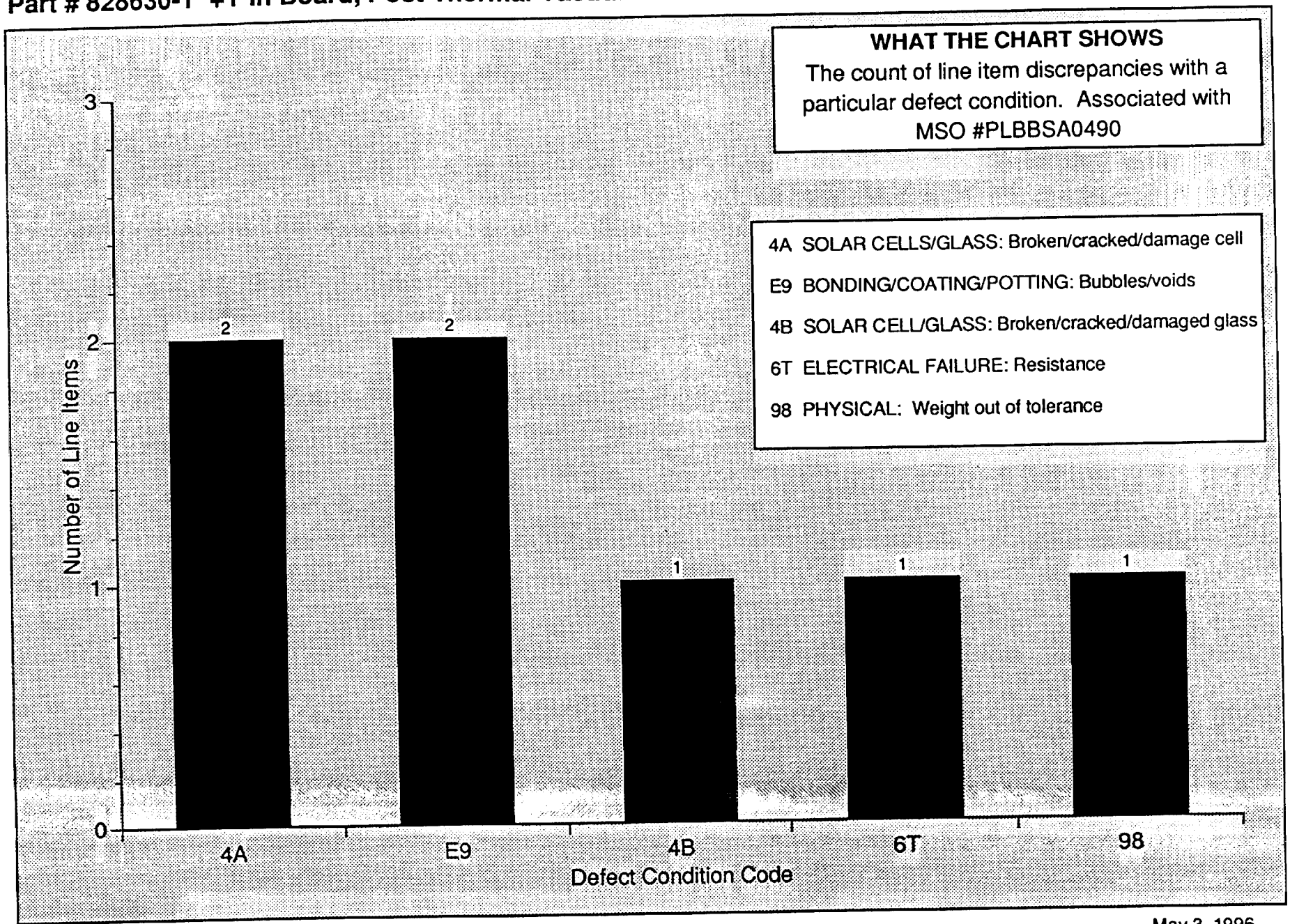
YY MISCELLANEOUS: Cannot be classified



May 3, 1996

Power Sources- Project TRMM (Panel +Y nboard)

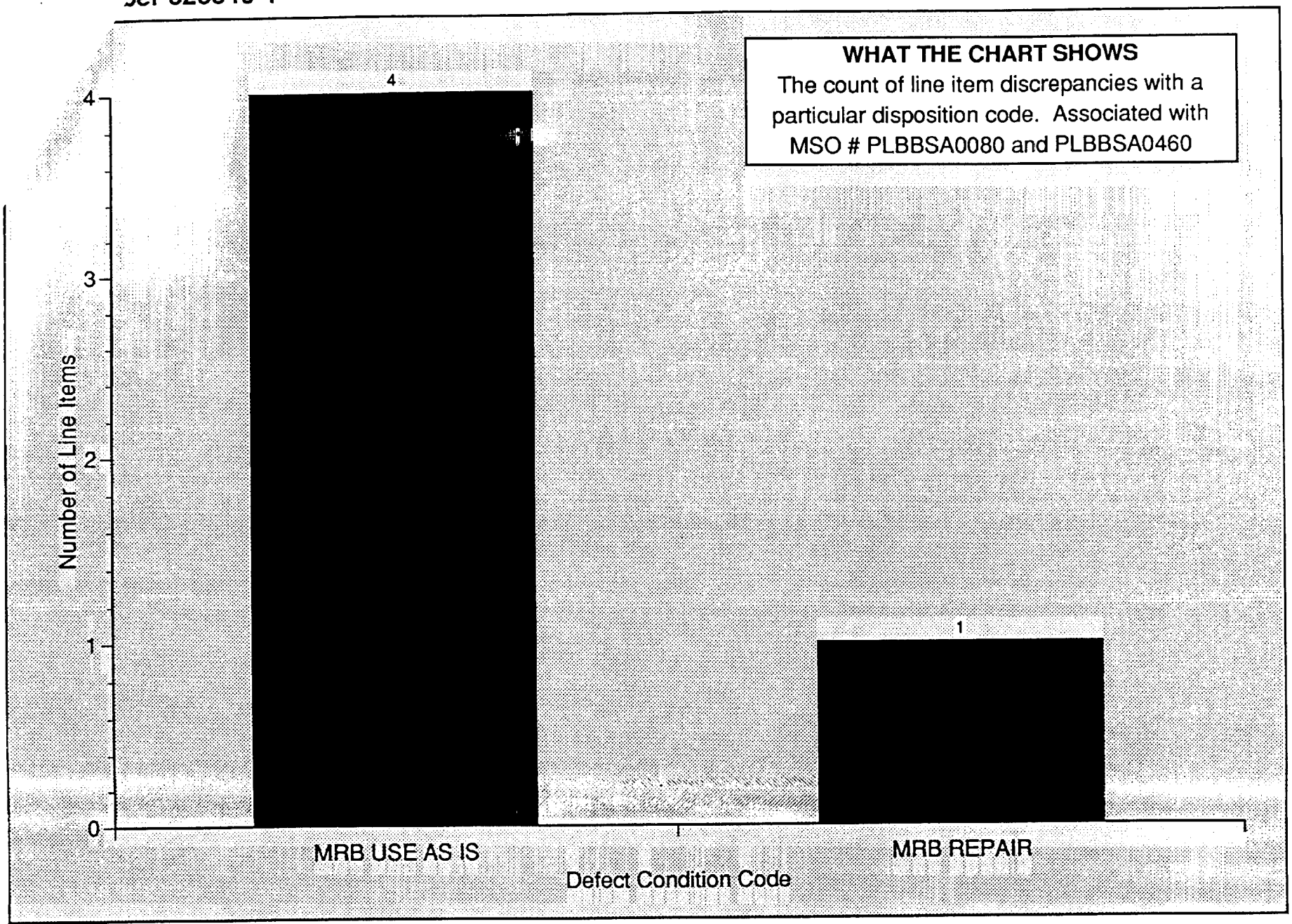
Part # 828630-1 +Y In Board, Post Thermal Vacuum



May 3, 1996

Summary
Cracked cells at Panel Level

	PANEL NUMBER	PANEL NUMBER
PROCESS	828340-1	828360-1
POST LAY-UP	44	12
POST ACOUSTIC	0	0
POST THERMAL VACUUM	56	24
TOTAL	100	35


WHAT THE CHART SHOWS
The count of line item discrepancies with a particular disposition code. Associated with MSO # PLBBSA0080 and PLBBSA0460
Number of Line Items
0
1
2
3
4
4
1
MRB USE AS IS
MRB REPAIR
Defect Condition Code

May 3, 1996

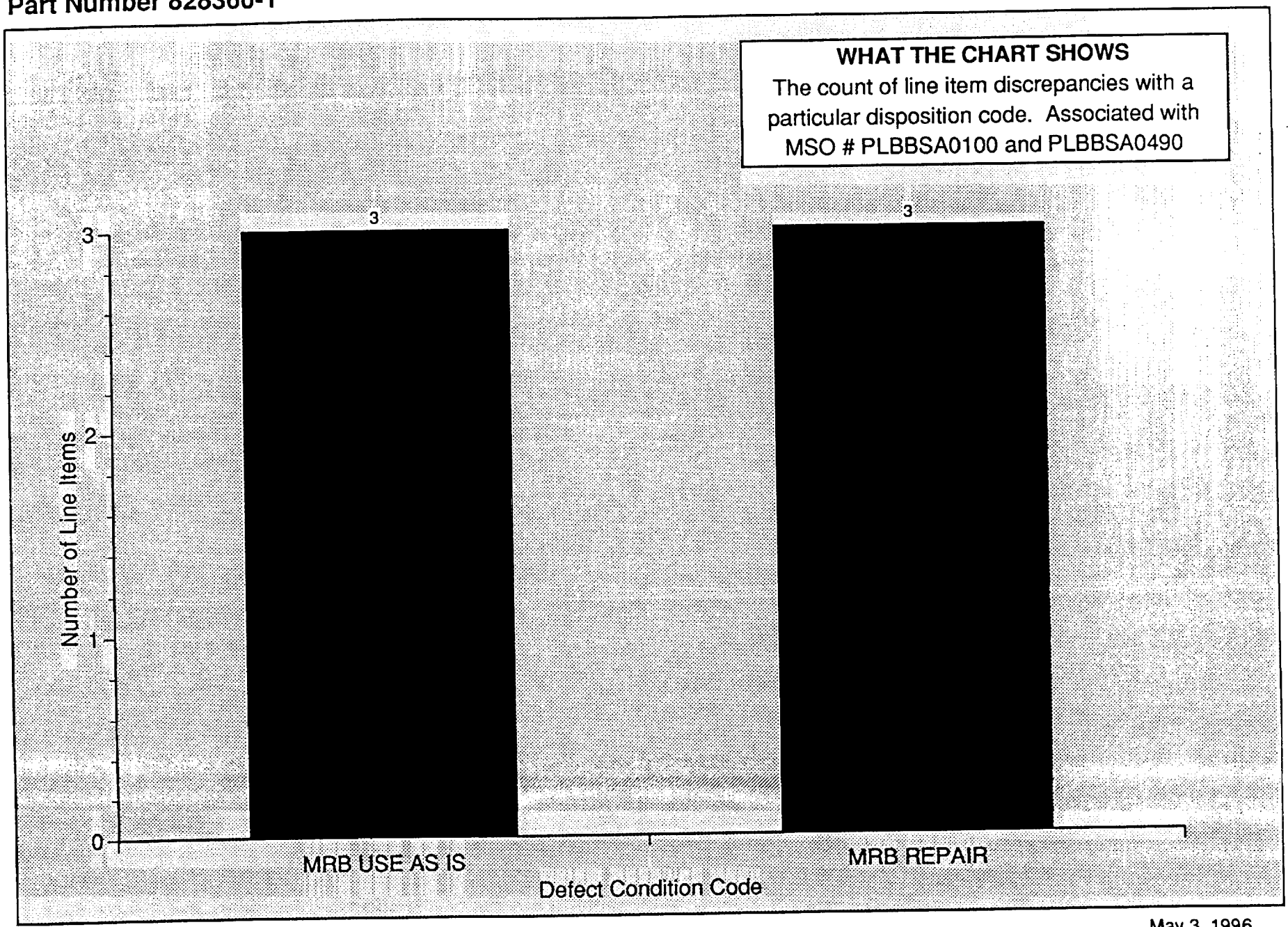
Power Sources- Project TRMM

Defect Conditions associated with MRB Repair and Use As Is dispositions for MSO numbers PLBBSA0080 AND PLBBSA0460.

DR #	LI	DISPOSITION	MSO	DEFECT COND
RR4430	1	MRB REPAIR	PLBBSA0080	PHYSICAL: Misaligned/misoriented
RR4533	3	MRB USE AS IS	PLBBSA0080	SOLAR CELLS/GLASS: Broken/cracked/damaged cell
RR4533	7	MRB USE AS IS	PLBBSA0080	MISCELLANEOUS: Cannot be determined
RR4897	11	MRB USE AS IS	PLBBSA0460	SOLAR CELLS/GLASS: Broken/cracked/damaged cell
RR4750	1	MRB USE AS IS	PLBBSA0080	PROCESS: In-process testing

Power Sources- Project TRMM (+Y Inbd)

Part Number 828360-1



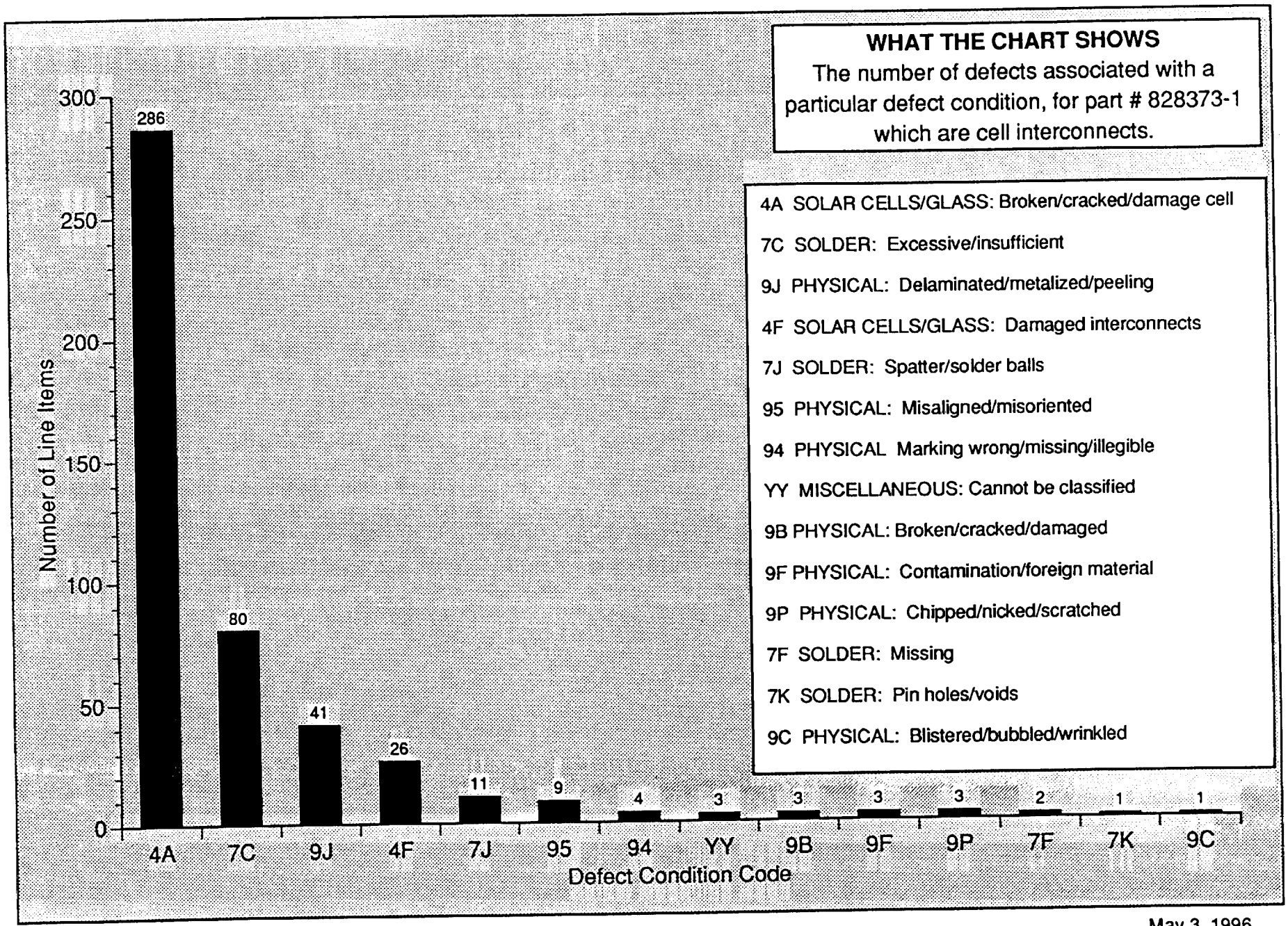
May 3, 1996

Pow Sources- Project TRMM

Defect Conditions associated with MRB Repair and Use As Is dispositions for MSO numbers PLBBSA0100 AND PLBBSA0490.

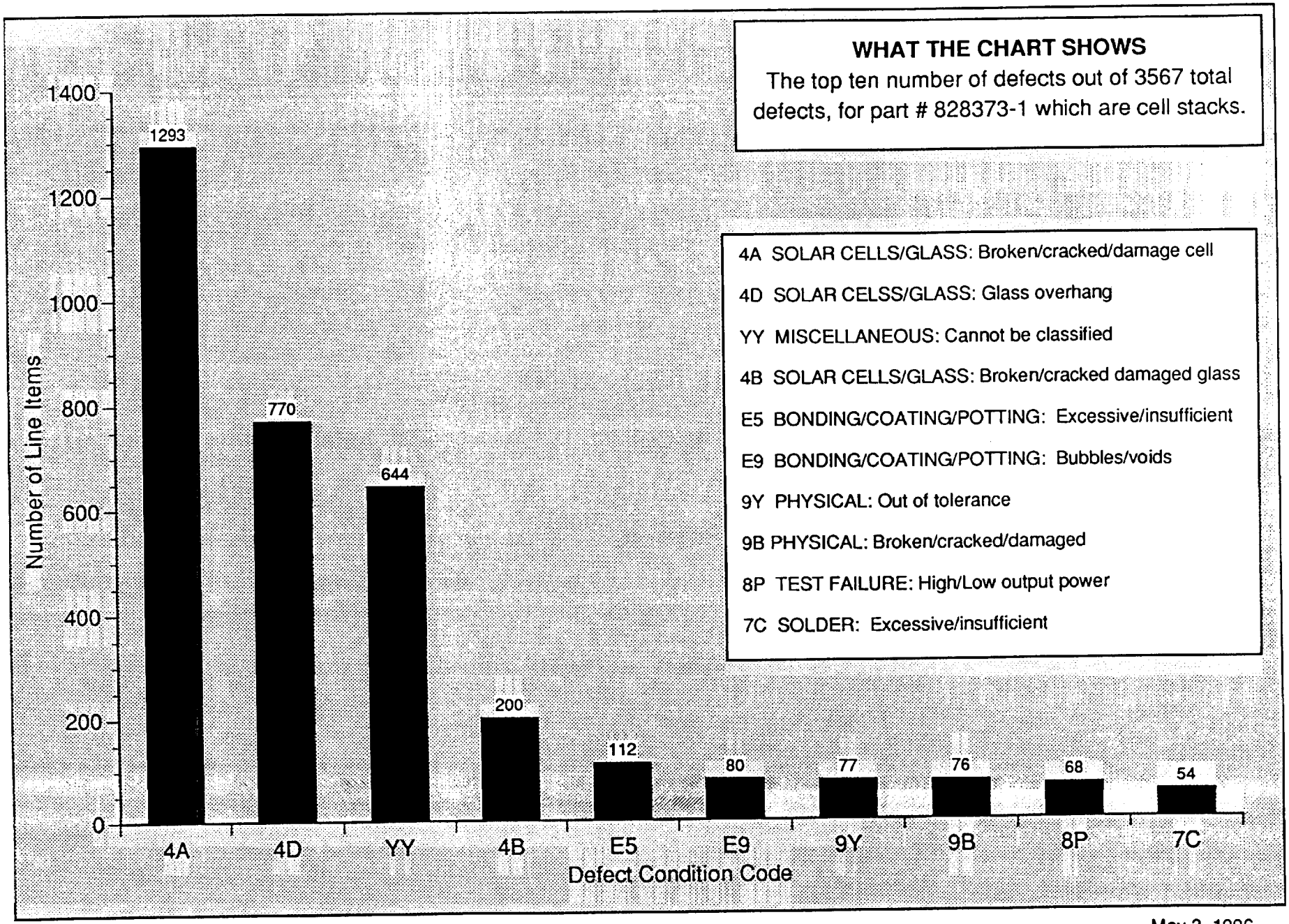
DR #	LI	DISPOSITION	MSO	DEFECT CONDITION
RR4620	2	MRB REPAIR	PLBBSA0100	WIRE/CONDUCTOR/CABLE/HARNESS: Missing
RR4895	3	MRB REPAIR	PLBBSA0490	BONDING/COATING/POTTING: Bubbles/voids
RR4737	3	MRB REPAIR	PLBBSA0100	SOLAR CELLS/GLASS: Chipped glass/proton
RR4732	1	MRB USE AS IS	PLBBSA0100	MISCELLANEOUS: Cannot be classified
RR4817	1	MRB USE AS IS	PLBBSA0490	PHYSICAL:Weight out of tolerance
RR4817	2	MRB USE AS IS	PLBBSA0490	ELECTRICAL FAILURE: Resistance

Pow(Sources- Project TRMM



May 3, 1996

Pow(Sources- Project TRMM



May 3, 1996

TRW

TRMM
PANEL 828340-2 AND 828350-1

- NMR Summary
  - Paretto Charts
- Summary of cracked cells by process
- Use as is and repair Disposition summary
  - Paretto Charts

June 27, 1996
Fernando Corella

828340-2 - Y OUTBOARD S/A PANEL
TRMM Panel Q.A. NMR Summary

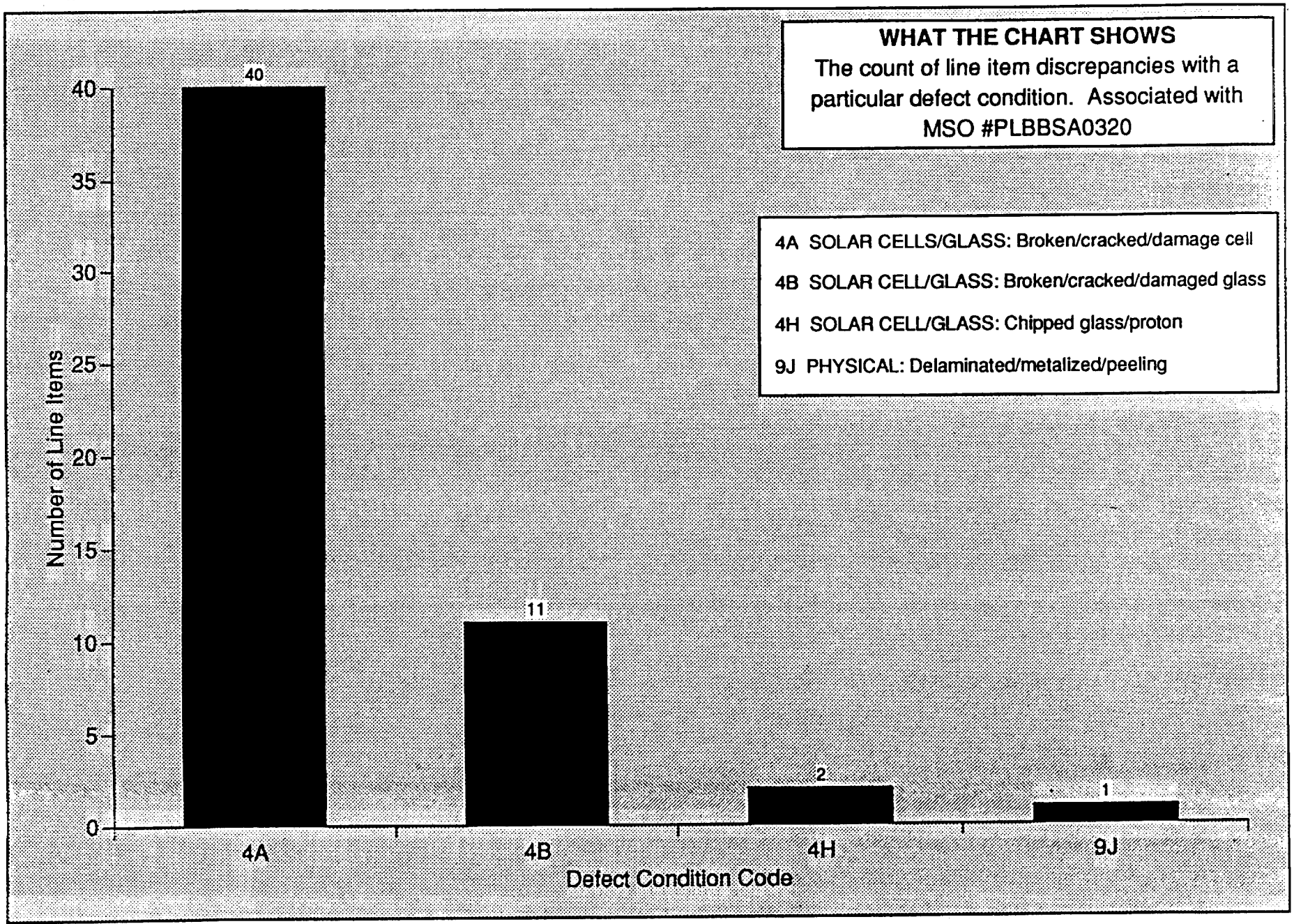
MODULE ASSEMBLY Defect Type	Number of Line Items	Corrective Action
Cracked cells	40	Inherent limitation, None Required
Cracked coverglass	11	Inherent limitation, None Required
Chipped coverglass	1	Inherent limitations, None Required
P- collector strip delamination	2	Supplier Action
PANEL ASSEMBLY		
Cracked Cells	1	Inherent Limitation, None Required
Cracked Coverglass	1	Inherent Limitation, None Required
Thermistor resistance did not fall within	1	None required GSFC
tolerance band . (RT1,RT2)	1	directed procurement of device
Wire Sleeving Damaged	1	Employee counseled
POST ACOUSTIC		
No Defects		

828340-2 -Y OUTBOARD S/A PANEL
TRMM Panel Q.A. NMR Summary

Post Thermal Vacuum Defect Type	Number of Line Items	Corrective Action
Cracked Cells	2	Inherent limitations of the process: manufacturing and environmental testing
Damaged Glass	1	Employee counseled
Bubbles Formed on Panel From Thermal Test	1	Under Investigation
Delaminated Coverglass	1	Inherent limitations of the process: Manufacturing any environmental testing

P(er Sources- Project TRMM (Modu(Assembly)

Part # 828340-2 -Y Outboard Panel



June 25, 1996

Pow(Sources- Project TRMM (Panel A(embly)

Part # 828340-2 -Y Out Board Panel

WHAT THE CHART SHOWS

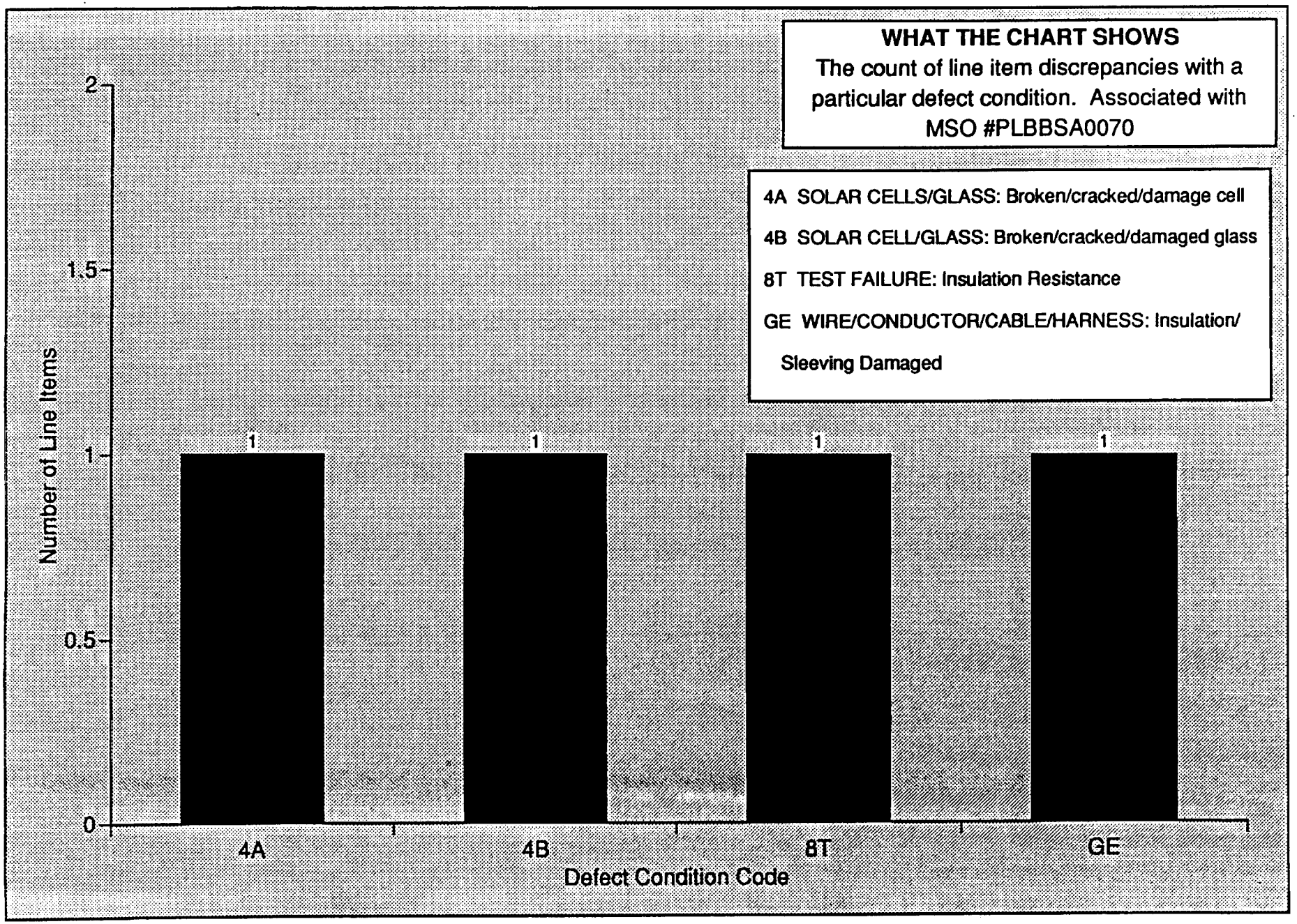
The count of line item discrepancies with a particular defect condition. Associated with MSO #PLBBSA0070

4A SOLAR CELLS/GLASS: Broken/cracked/damage cell

4B SOLAR CELL/GLASS: Broken/cracked/damaged glass

8T TEST FAILURE: Insulation Resistance

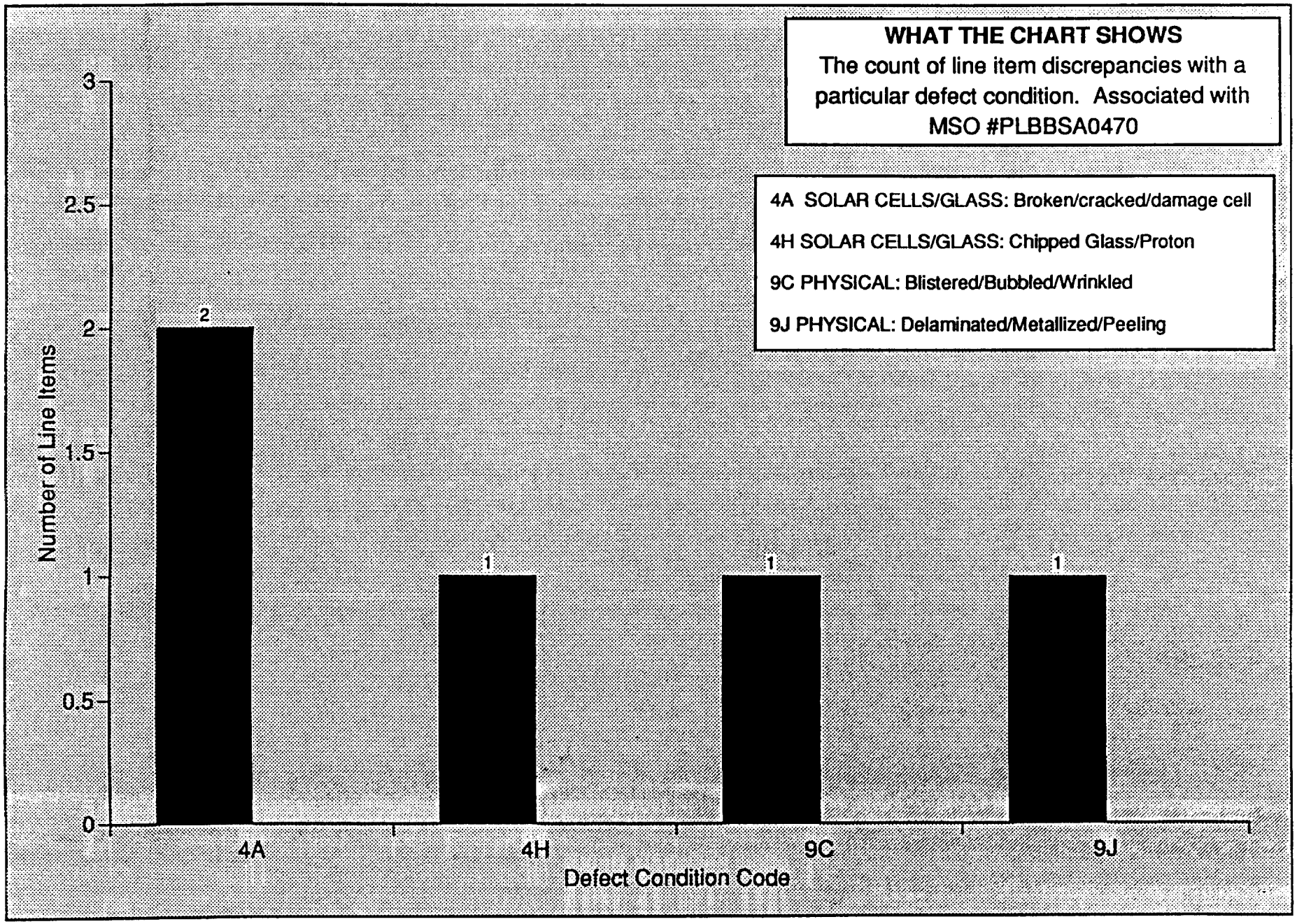
GE WIRE/CONDUCTOR/CABLE/HARNESS: Insulation/ Sleeving Damaged



June 25, 1996

Power Sources- Project TRMM

Part # 828340-2 -Y Out Board Panel (Post Environmental / Final Inspection)



June 25, 1996

828350-1 -Y INBOARD S/A PANEL
TRMM Panel Q.A. NMR Summary

MODULE ASSEMBLY Defect Type	Number of Line Items	Corrective Action
Cracked Cells	40	Inherent limitation, none required
Cracked Coverglass	3	Inherent limitations, none required
Cell Grading Required	2	Inherent limitations, none required
Insufficient Solder in Solder Joint	1	Inherent limitations, none required
Delaminated P-Collection Strip	1	Supplier action
PANEL ASSEMBLY		
Cracked Cells	2	Inherent limitations of the lay-down process none required
Cracked Coverglass/Chipped Coverglass	2	Inherent limitations, none required
Thermistor Resistance Failure, Not Within Tolerance Band (RT1, RT2)	1	None required, data will be reported to GSFC who directed the procurement of this device
Shorted Wire on BT1 and BT68	1	Under investigation

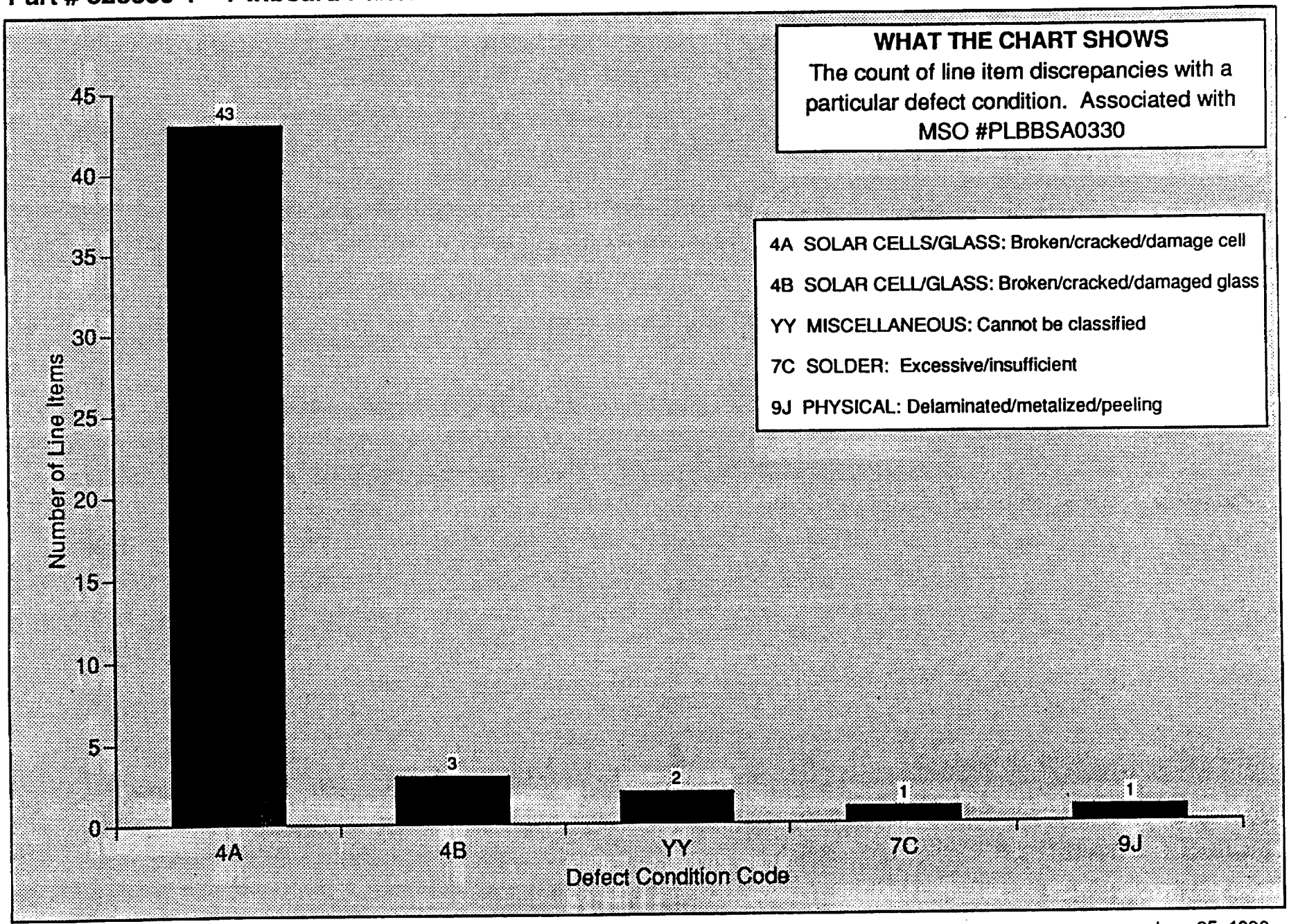
828350-1 -Y INBOARD S/A PANEL
TRMM Panel Q.A. NMR Summary

POST ACOUSTIC Defect Type	Number of Line Items	Corrective Action
No defects		

POST THERMAL VACUUM		
Bubbles Formed on Panel After Thermal Test	1	Under investigation
Cracked Cells	4	Inherent limitations of the process: manufacturing and environmental testing
Cracked Coverglass	1	Inherent limitations of the process: manufacturing and environmental testing
Damaged interconnect, damaged during a rework operation	1	Employee counseled
Chipped coverglass	1	Inherent limitations, None Required

Pow[illegible] Sources- Project TRMM (Module[illegible] ssembly)

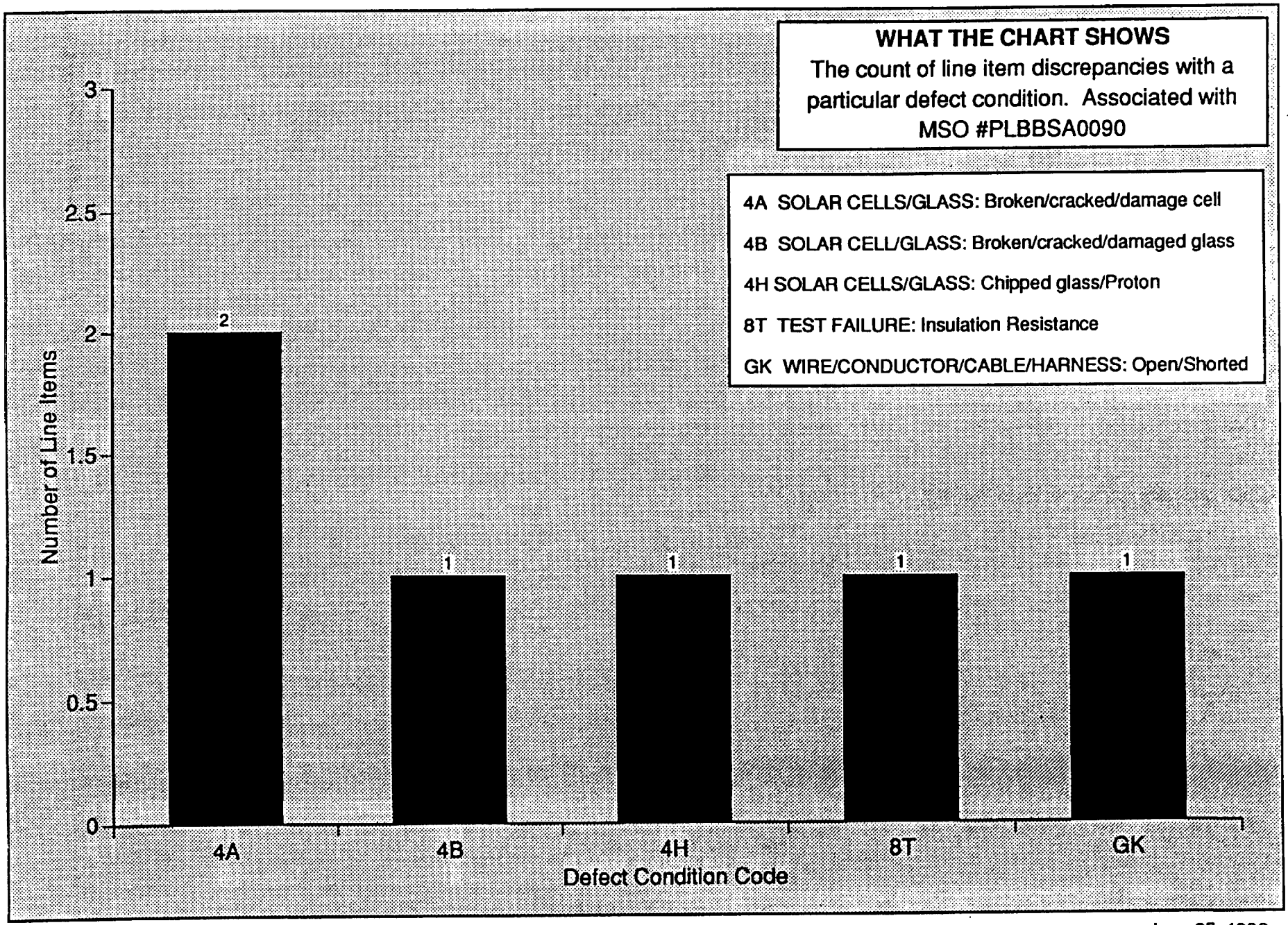
Part # 828350-1 -Y Inboard Panel



June 25, 1996

Pow Sources- Project TRMM (Panel A embly)

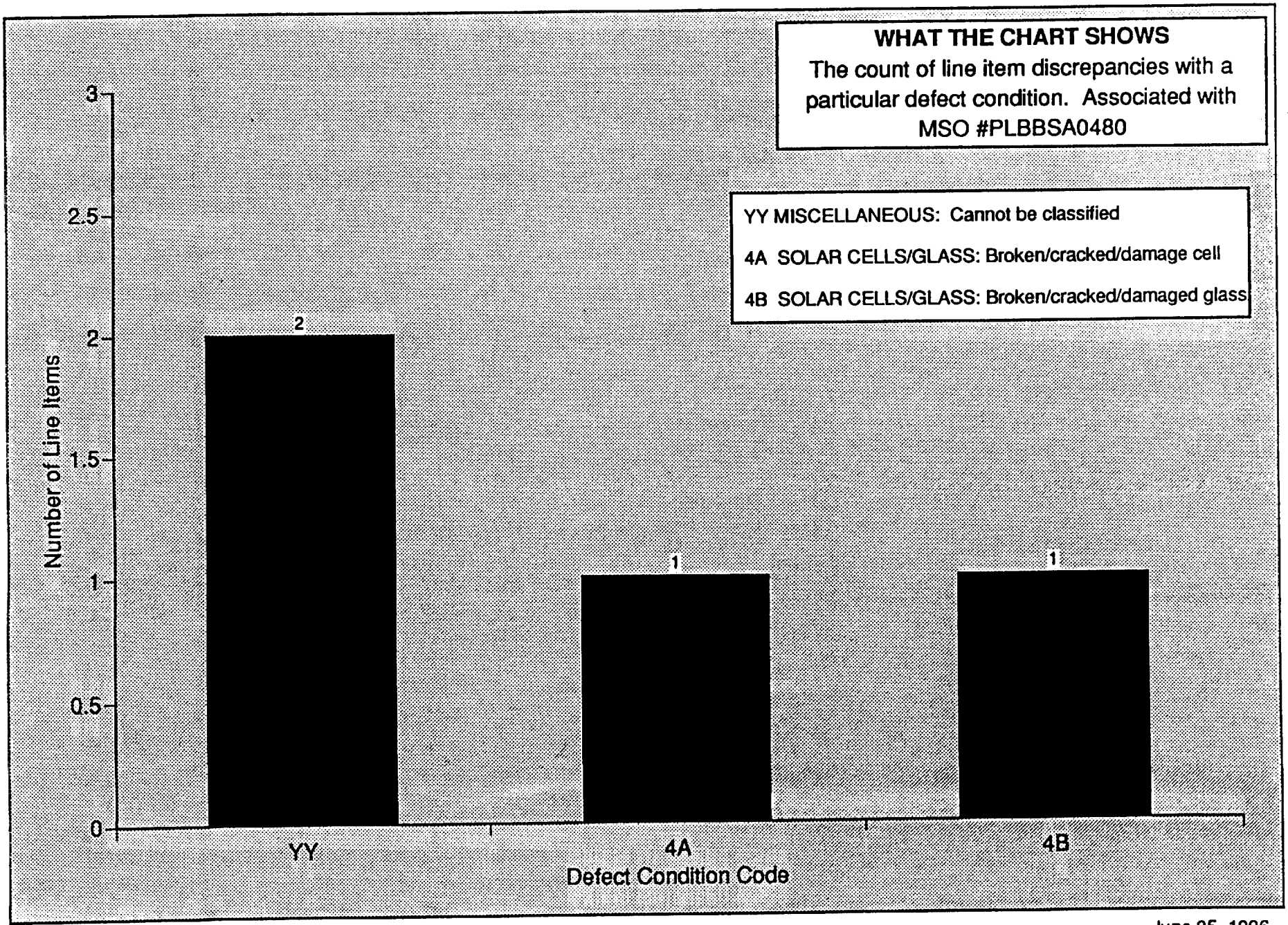
Part # 828350-1 -Y Inboard Panel



June 25, 1996

Pow[illegible] Sources- Project TRMM

Part # 828350-1 -Y In Board Panel (Post Environmental / Final Inspection)



June 25, 1996

Summary
Cracked cells at Panel Level

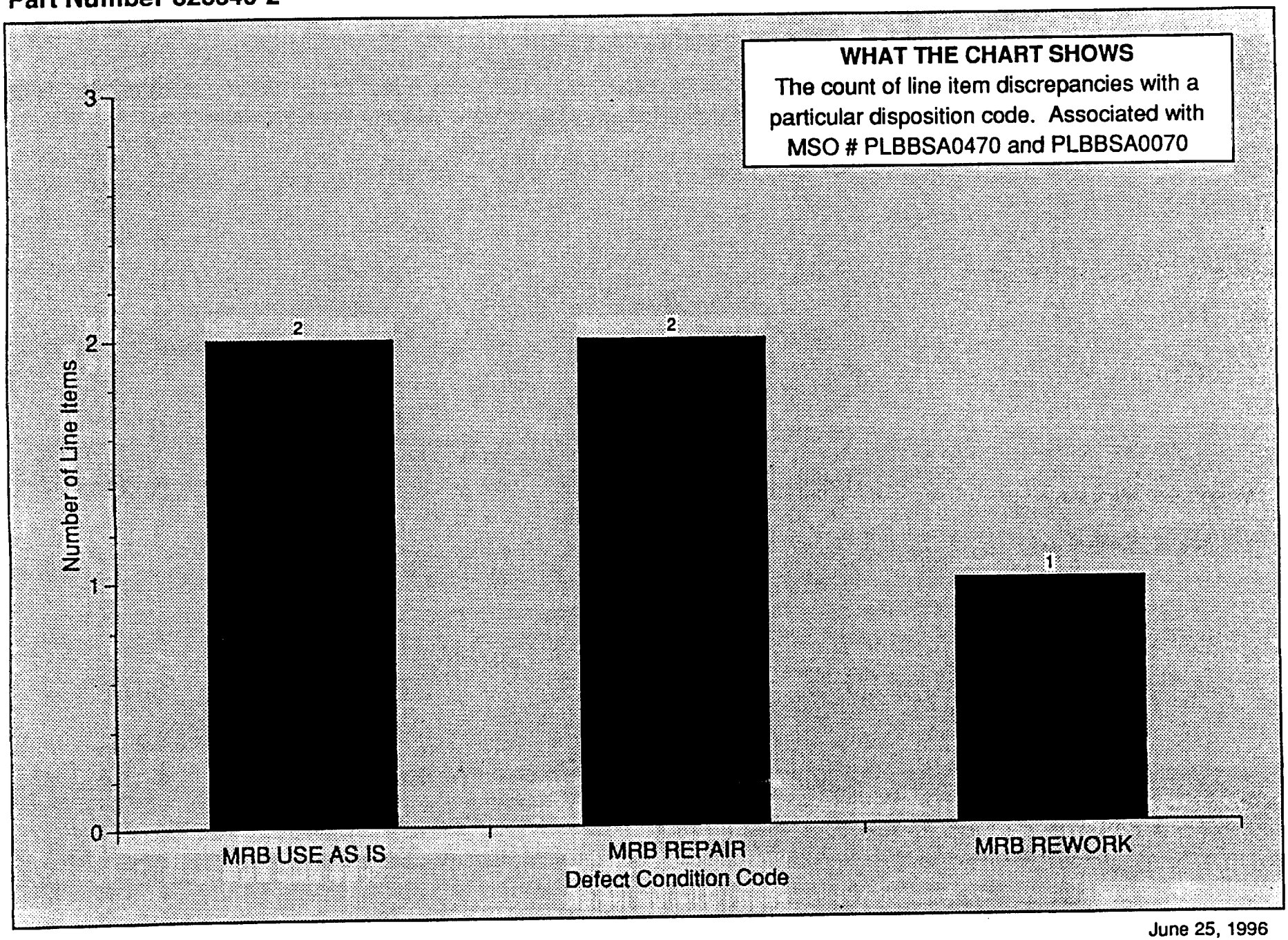
	PANEL NUMBER *	PANEL NUMBER *
PROCESS	828340-1	828360-1
POST LAY-UP	44	12
POST ACOUSTIC	0	0
POST THERMAL VACUUM	56	24
TOTAL	100	35

* For reference only

	PANEL NUMBER	PANEL NUMBER
PROCESS	828340-2	828350-1
POST LAY-UP	5	18
POST ACOUSTIC	0	0
POST THERMAL VACUUM	14	20
TOTAL	19	38

Powe. Sources- Project TRMM (-Y Outbc .d Panel)

Part Number 828340-2



June 25, 1996

Power Sources- Project TRMM (-Y Outboard Panel)

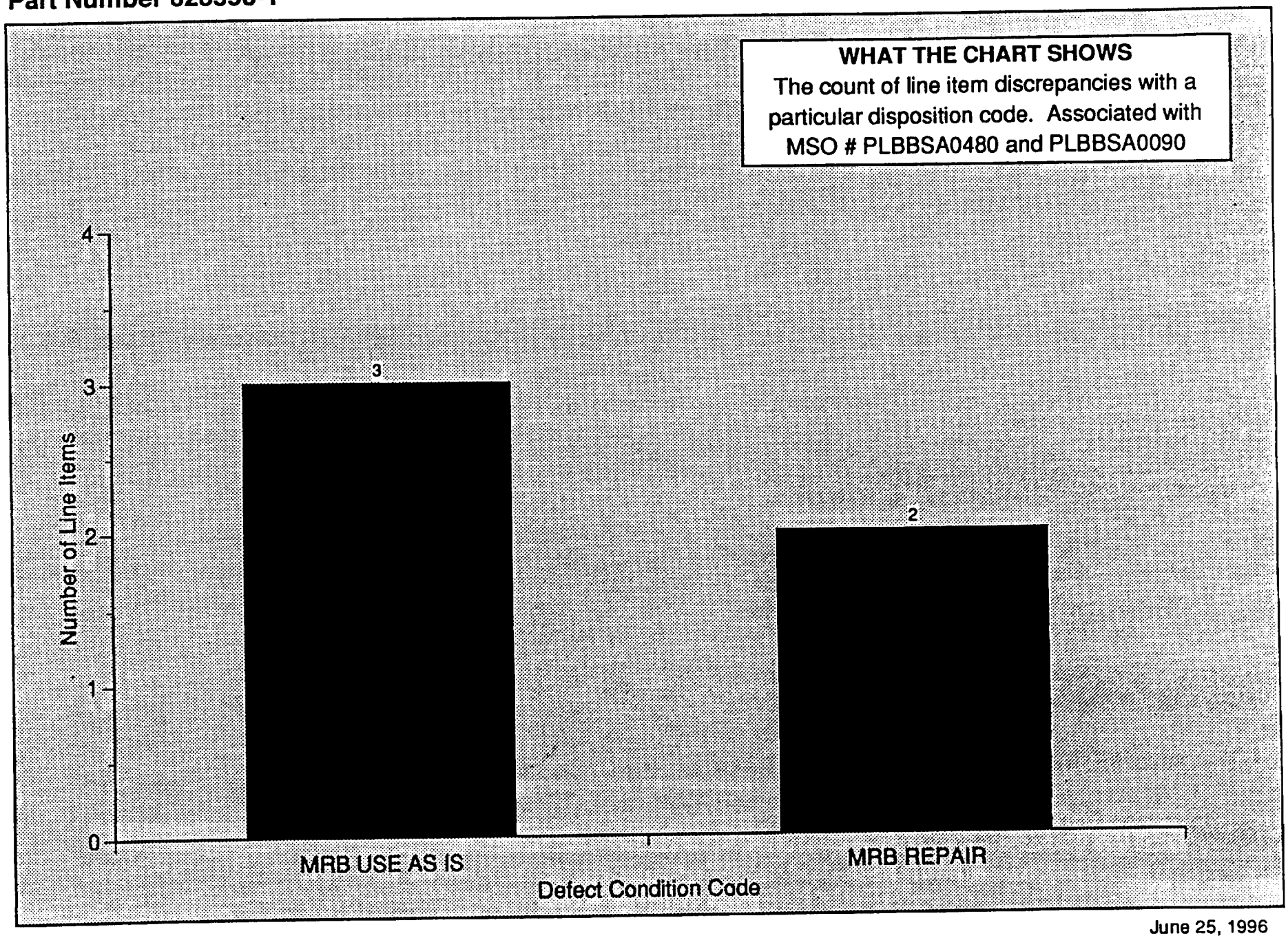
Part Number 828340-2

Defect Conditions associated with MRB Repair and Use As Is dispositions for MSO numbers PLBBSA0470 AND PLBBSA0070.

DR #	LI	DISPOSITION	MSO	DEFECT CONDITION
RR5572	1	MRB USE AS IS	PLBBSA0070	TEST FAILURE: Insulation Resistance
RR5678	3	MRB USE AS IS	PLBBSA0470	PHYSICAL: Blistered/Bubbled/Wrinkled
RR5380	1	MRB REPAIR	PLBBSA0070	WIRE/CONDUCTOR/CABLE/HARNESS: Insulation/Sleeving
RR5678	4	MRB REPAIR	PLBBSA0470	SOLAR CELLS/GLASS: Chipped Glass/Proton
RR5678	2	MRB REWORK	PLBBSA0470	PHYSICAL: Delaminated/Metalized/Peeling

Power Sources- Project TRMM (-Y Inboard Panel)

Part Number 828350-1



June 25, 1996

Pow Sources- Project TRMM (-Y Inboa Panel)

Part Number 828350-1

Defect Conditions associated with MRB Repair and Use As Is dispositions for MSO numbers PLBBSA0480 AND PLBBSA0090.

DR #	LI	DISPOSITION	MSO	DEFECT CONDITION
RR5579	1	MRB USE AS IS	PLBBSA0090	TEST FAILURE: Insulation Resistance
RR5679	3	MRB USE AS IS	PLBBSA0480	MISCELLANEOUS: Cannot Be Classified
RR5679	7	MRB USE AS IS	PLBBSA0480	TEST FAILURE: High/Low Output Power
RR5272	1	MRB REPAIR	PLBBSA0090	WIRE/CONDUCTOR/CABLE/HARNESS: Open/Shorted
RR5679	5	MRB REPAIR	PLBBSA0480	MISCELLANEOUS: Cannot Be Classified